- General Troubleshooting Information

Before Troubleshooting

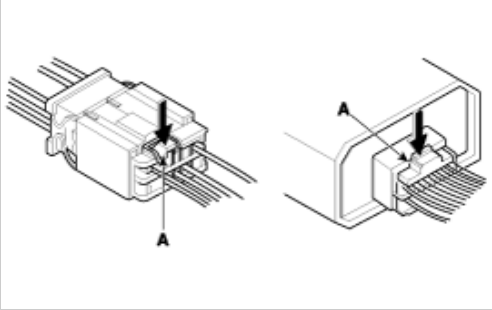
1. Check applicable fuses in the appropriate fuse/relay box.
2. Using the battery checker (MCR-570 KIT), check the battery for damage, state of charge, and clean and tight connections.
   (Refer to Engine Electrical System - "Battery")

> **NOTICE**
> - Do not quick-charge a battery unless the battery ground cable has been disconnected, otherwise you will damage the alternator diodes.
> - Do not attempt to crank the engine with the battery ground cable loosely connected or you will severely damage the wiring.

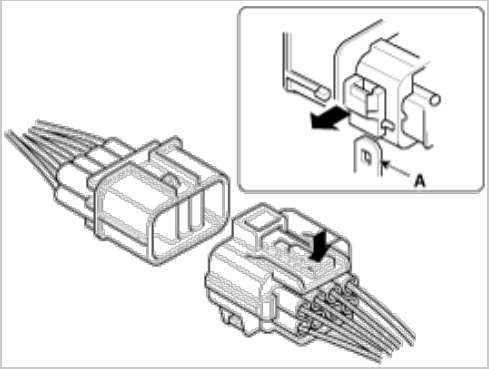
3. Check the alternator belt tension (D).

Handling Connectors

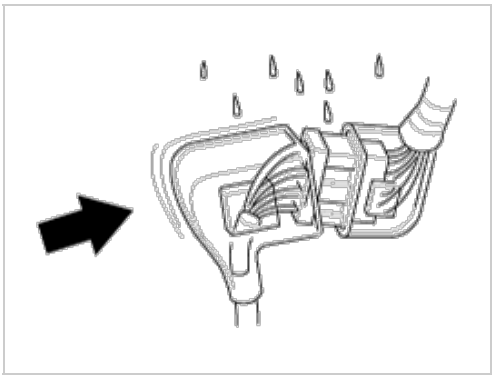
1. Make sure the connectors are clean and have no loose wire terminals.
2. Make sure multiple cavity connectors are packed with grease (except watertight connectors).
3. All connectors have push-down release type locks (A).



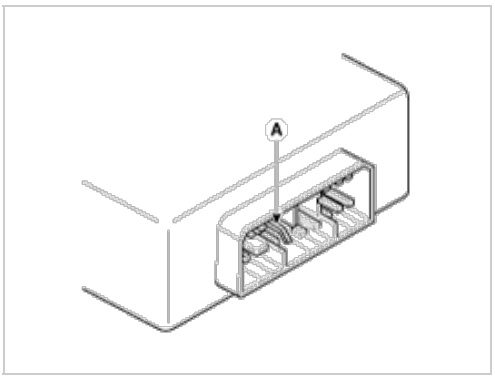
4. Some connectors have a clip on their side used to attach them to a mount bracket on the body or on another component. This clip has a pull type lock.
5. Some mounted connectors cannot be disconnected unless you first release the lock and remove the connector from its mount bracket (A).



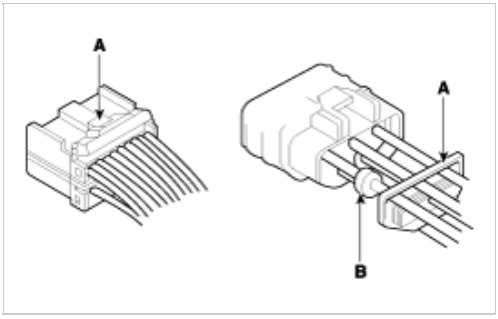
6. Never try to disconnect connectors by pulling on their wires pull on the connector halves instead.
7. Always reinstall plastic covers.



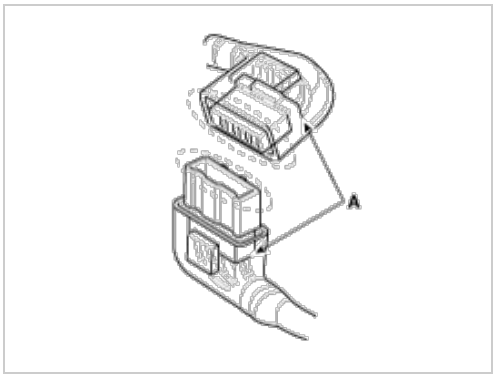
8. Before connecting connectors, make sure the terminals (A) are in place and not bent.



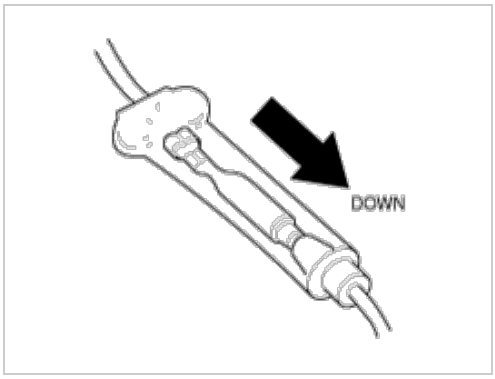
9. Check for loose retainer (A) and rubber seals (B).



10. The backs of some connectors are packed with grease. Add grease if necessary. If the grease (A) is contaminated, replace it.

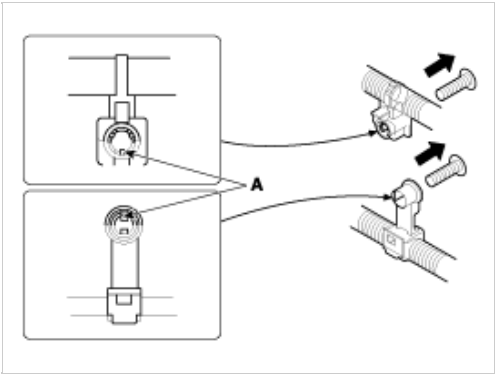


11. Insert the connector all the way and make sure it is securely locked.
12. Position wires so that the open end of the cover faces down.

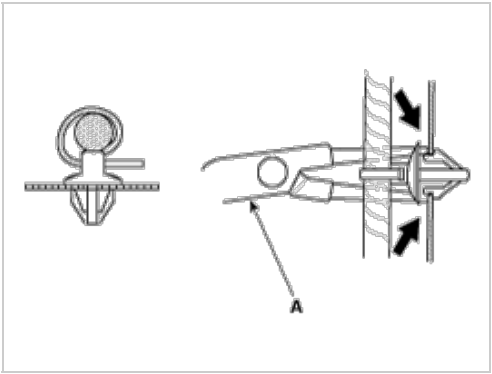


Handling Wires and Harnesses

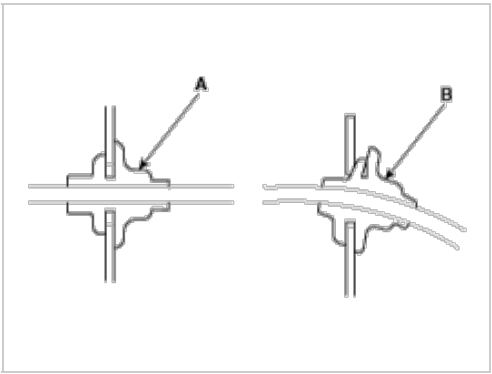
1. Secure wires and wire harnesses to the frame with their respective wire ties at the designated locations.
2. Remove clips carefully; don't damage their locks (A).



3. Slip pliers (A) under the clip base and through the hole at an angle, and then squeeze the expansion tabs to release the clip.

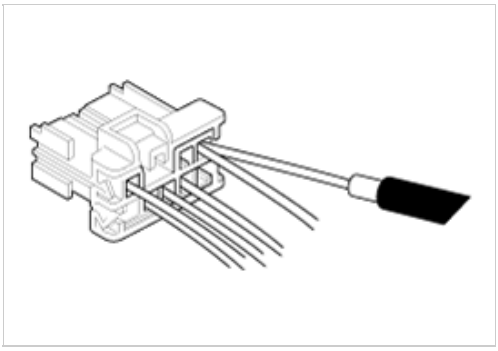


4. After installing harness clips, make sure the harness doesn't interfere with any moving parts.
5. Keep wire harnesses away from exhaust pipes and other hot parts, from sharp edges of brackets and holes, and from exposed screws and bolts.
6. Seat grommets in their grooves properly (A). Do not leave grommets distorted (B).

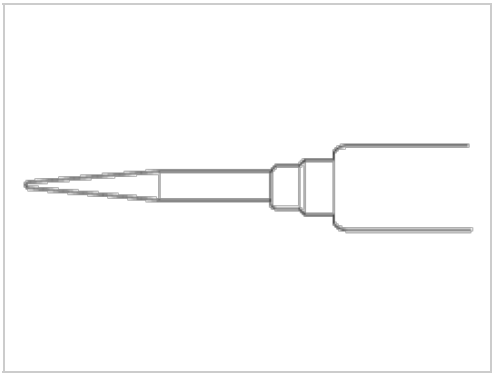


Testing and Repairs

1. Do not use wires or harnesses with broken insulation.
   Replace them or repair them by wrapping the break with electrical tape.
2. After installing parts, make sure that no wires are pinched under them.
3. When using electrical test equipment, follow the manufacturer's instructions and those described in this manual.
4. If possible, insert the remover tool from the wire side (except waterproof connector).



5. Use a probe with a tapered tip.
   Refer to the user's guide in the wiring repair kit (Pub No. : TRK 015.)



Five-step Troubleshooting

1. Verify the complaint
   Turn on all the components in the problem circuit to verify the customer complaint. Note the symptoms. Do not begin disassembly or testing until you have narrowed down the problem area.
2. Analyze the schematic
   Look up the schematic for the problem circuit.
   Determine how the circuit is supposed to work by tracing the current paths from the power feed through the circuit components to ground. If several circuits fail at the same time, the fuse or ground is a likely cause.
   Based on the symptoms and your understanding of the circuit operation, identify one or more possible causes of the problem.
3. Isolate the problem by testing the circuit.
   Make circuit tests to check the diagnosis you made in step 2. Keep in mind that a logical, simple procedure is the key to efficient troubleshooting.
   Test for the most likely cause of failure first. Try to make tests at points that are easily accessible.
4. Fix the problem
   Once the specific problem is identified, make the repair. Be sure to use proper tools and safe procedures.
5. Make sure the circuit works
   Turn on all components in the repaired circuit in all modes to make sure you've fixed the entire problem. If the problem was a blown fuse, be sure to test all of the circuits on the fuse. Make sure no new problems turn up and the original problem does not recur.

Battery Reset

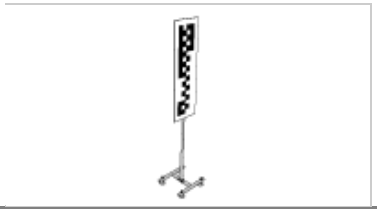
Description

When reconnecting the battery cable after disconnecting, recharging battery after discharged or installing the memory fuse located on the driver's side panel after removing, be sure to reset systems mentioned on the below table.

In addition, when replacing or reinstalling their fuses after removing, they should be reset according to the below table. Please refer to the below table when servicing.

System	Resetting
Auto up/down window	Whenever the battery is disconnected, discharged or the related fuse is replaced or reinstalled, reset the Auto up/down window system according to the procedure below. **Information** You need to reset the sunroof motor to its default settings for the following cases : – The sunroof motor loses battery power temporarily because the battery or fuse is replaced or the battery has died. – The automatic opening or closing of the sunroof, a one-touch feature, does not function properly. – The sunroof reopens during automatic closing even if there is no object caught in the sunroof (safety feature) 1) Turn the ignition switch to the ON position. 2) Pull up the power window switch in order that the window can close completely, and then keep pulling up the power switch for about 1 second.
Panoramaroof	Whenever the battery is disconnected, discharged or the related fuse is replaced or reinstalled, the panoramaroof system must be reset according to the procedure below. 1) Turn the ignition key to the ON position and then close the panoramaroof completely. 2) Release the panoramaroof control lever. 3) Press and hold the CLOSE button for more than 10 seconds until the sunroof has moved slightly. 4) Release the panoramaroof control lever. 5) Press and hold the CLOSE button once again until the sunroof do as follows. • Tilt → Slide Open → Slide Close Then, release the lever. 6) Reset procedure of panorama system is finished.
Trip computer	When the battery is disconnected and reconnected, the set functions of the trip computer become initialized. So, you need to explain this information to the customer.
Clock	Whenever the battery terminals or related fuses are disconnected, you must reset the time in audio head unit. (Refer to Audio owner's manual)
Audio	When the battery is disconnected and reconnected, the customer's radio stations become initialized. So, you need to record the customer's radio stations prior to service, and after service, set the customer's radio stations into the audio.

- Special Service Tools

Tool (Number and Name)	Illustration	Application
Correction jig for LDW or LKA (09890-3V100)		Correction of LDW (Lane Departure Warning) or LKA (Lane Keeping Assist).
Vertical Measuring Device (09964-C1200)		Correction front view camera
RKE Battery Checker (09954-2P100)		Measuring the RKE battery voltage.

Blind-Spot Radar Unit Correction Tool Set (09958-3T500)		Used to correct the Blind-Spot Radar unit.
Vertical Plumb (09958-3T010)		Used to correct the Blind-Spot Radar unit.Used to create a center line. (Use with 09958-3T020, 09958-3T030, 09958-3T040, 09958-3T060)
Spirit Level (09958-3T070)		Used to correct the Blind-Spot Radar unit.Used to measure the horizontal angle. (Use with 09958-3T080, 09958-3T090, 09958-3T120)
Blind-Spot Radar Unit Fixing Adaptor (09958-3T080)		Used to correct the Blind-Spot Radar unit.Used to measure the horizontal angle. (Use with 09958-3T070, 09958-3T090, 09958-3T120)
Digital Protractor (09958-3T090)		Used to correct the Blind-Spot Radar unit.Used to measure the horizontal angle. (Use with 09958-3T070, 09958-3T080, 09958-3T120)
Digital Inclinometer (09958-3T100)		Used to correct the Blind-Spot Radar unit.Used to measure the vertical angle.
Case & Manual & String (09958-3T120)		Used to correct the Blind-Spot Radar unit to measure the horizontal angle.

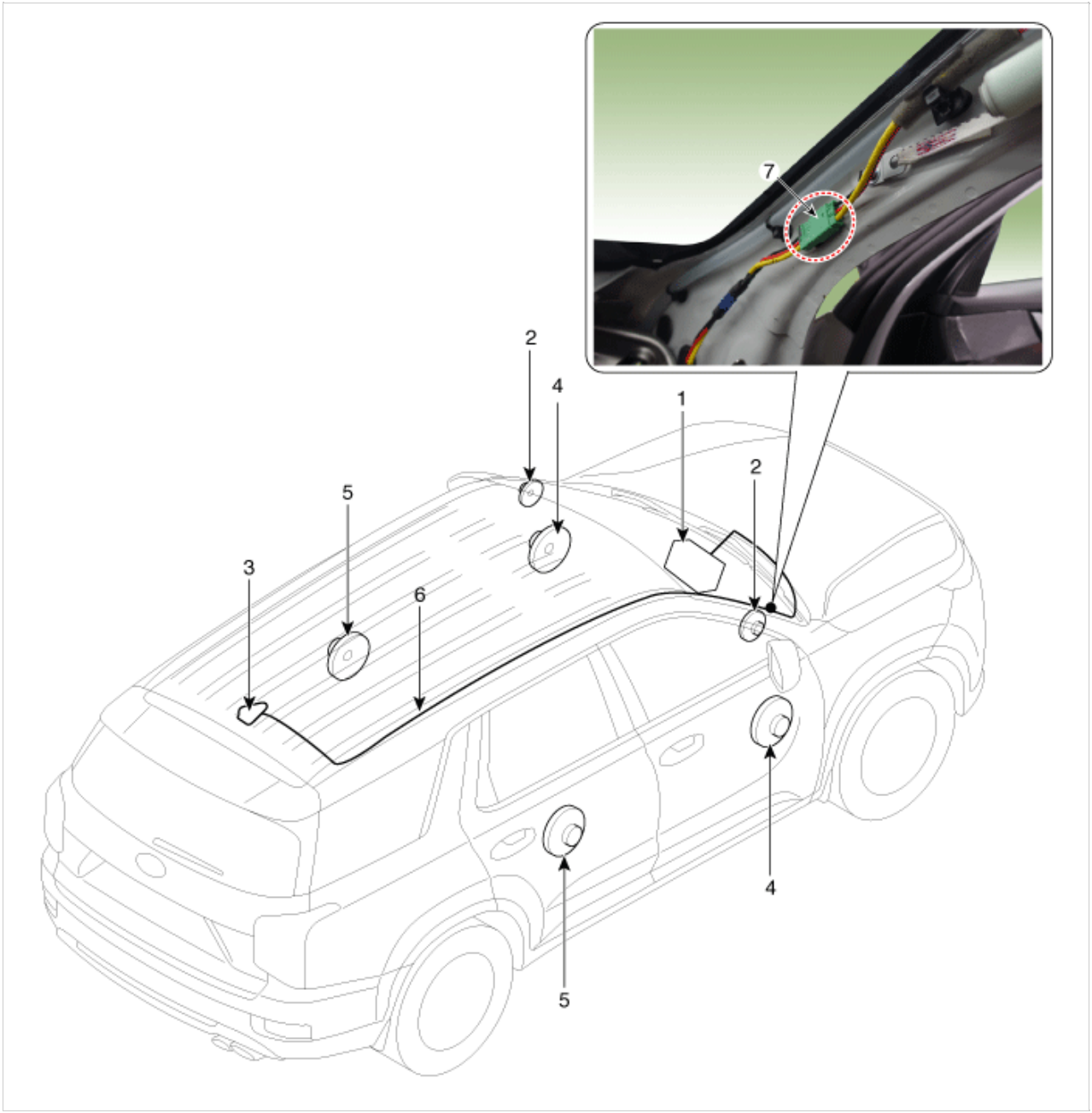
- Specifications

Audio

Item	Specification
Model	Display Audio 2.0
Power supply	DC 14.4V
Parasitic current	Max. 1mA (Head unit only)
Antenna	80PF 75Ω

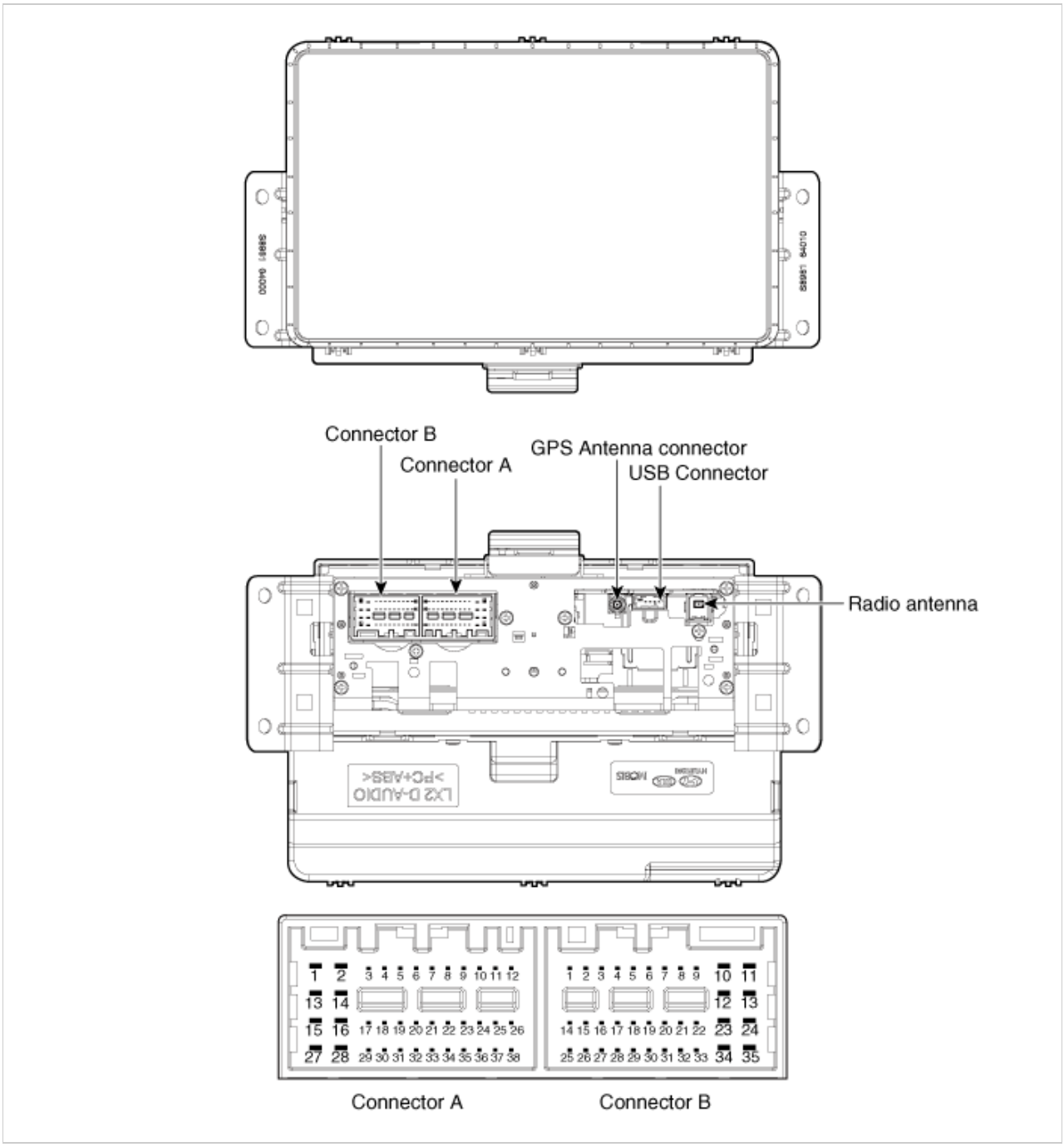
Tuning type		PLL synthesized type
Frequency range / Channel space	FM	87.5 - 108.0 MHz / 100 KHz
	AM	531 - 1602 KHz / 9 KHz

- Component Location



1. Audio unit
2. Tweeter speaker
3. Roof antenna (Radio)
4. Front door speaker
5. Rear door speaker
6. Antenna feeder cable
7. Antenna cable connector

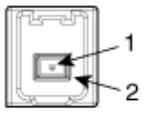
- Components

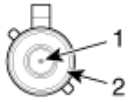


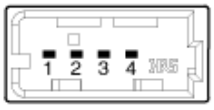
Connector Pin Information

No	Connector A	Connector B
1	Rear left speaker (+)	-
2	Rear left speaker (-)	Mic (+)
3	-	-
4	-	-
5	-	Antenna power
6	Camera _Power	Illumination (+)
7	Camera_ Video	MM CAN High
8	-	-
9	-	-
10	-	Battery (+)
11	DTC	Battery (+)
12	Steering wheel remote	Ground

13	Front left speaker (+)	Ground
14	Front left speaker (-)	-
15	Front right speaker (-)	Mic (+)
16	Front right speaker (+)	-
17	-	-
18	-	-
19	-	Illumination (-)
20	Camera power_Ground	MM CAN Low
21	Camera video_Ground	-
22	-	ACC
23	-	-
24	-	-
25	-	-
26	Steering wheel remote ground	-
27	Rear right speaker (-)	-
28	Rear right speaker (+)	-
29	-	-
30	-	-
31	-	-
32	-	Ignition
33	Camera shield _Ground	-
34	-	-
35	-	-
36	-	
37	-	
38	-	
39	Speed	

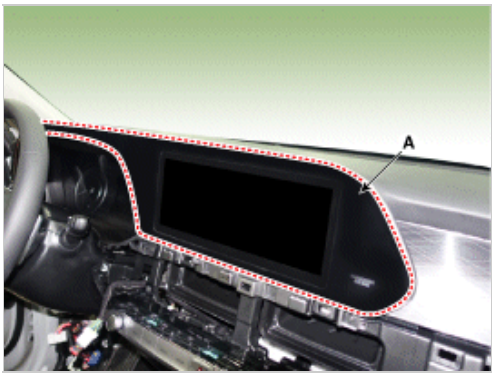
Radio antenna connector	PIN	Description	PIN	Description
	1	AM/FM	2	Ground

GPS antenna connector	PIN	Description	PIN	Description
	1	GPS	2	Ground

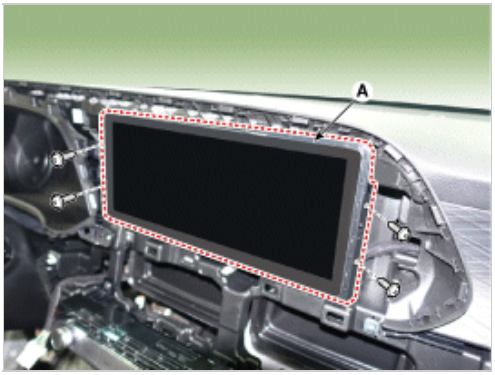
USB antenna connector	PIN	Description	PIN	Description
	1	USB_Power	3	USB_High
	2	USB_Low	4	USB_Ground

- Removal

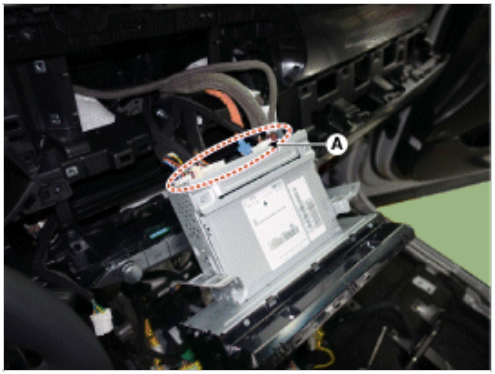
1. Disconnect the negative (-) battery terminal
2. Remove the center fascia panel.
   (Refer to Body - "Center Fascia Panel")
3. Using a flat-head screwdriver, remove the monitor cover (A).



4. Loosen mounting screws and then remove the audio assembly (A).



5. Remove the audio head unit after disconnecting connectors (A).



- Installation

1. Connect the audio unit connectors..
2. Install the audio head unit.
3. Install the monitor cover.
4. Install the center fascia panel.
5. Connect the negative (-) battery terminal.

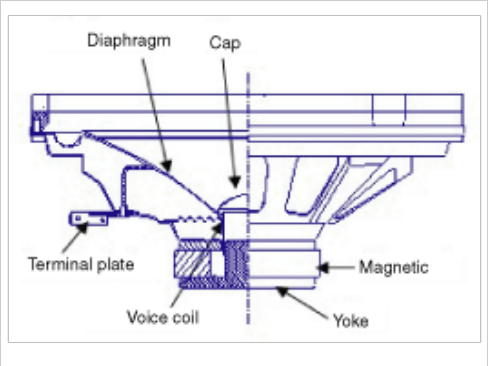
NOTICE

- Make sure the connector are connected in properly.
- Check the audio system.

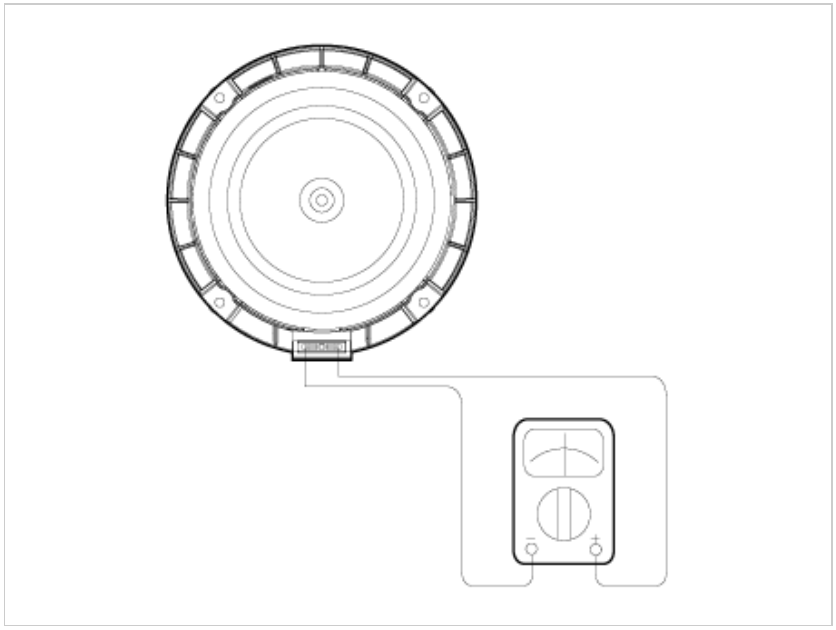
- Inspection

1. Troubleshooting for Speaker
   (1) Basic inspection of speaker

Inspect the sound from speaker after verifying that the speaker mounting screws is removed and the wiring connector is connected precisely to remove vibration transmitted from body trims and surrounding parts.



(2) Case Troubleshooting

No	Case	Inspection/Remedy
1	Trembling sound	1) Before replacing the speaker, inspect that the mounting screw is installed normally. 2) After re-installing the speaker, verify that no trembling sound is heard. 3) When hearing a trembling sound again, replace the speaker with new one.
2	Noise	1) Check if the wiring connector is connected normally. If not, reconnect the wiring connector. 2) In case of radio static, check if there is a noise from CD player. 3) When a noise is heard on turning radio and CD on, replace the speaker with new one. **NOTICE** • In case there is only radio static, this causes from poor radio reception. Thus the speaker needs no repair and replacement.
3	Poor working	Inspection of the wiring connection between the battery and the speaker 1) Before replacing the speaker, inspect the wiring and connections in the speaker circuit. 2) Check the supplying power to the speaker and the resistance, and then inspect the sound quality.  3) If the speaker works poorly, replace it with new one.

⚠ CAUTION

– During dealing of speaker

– Dropping or rough handling of the speaker can cause damage.

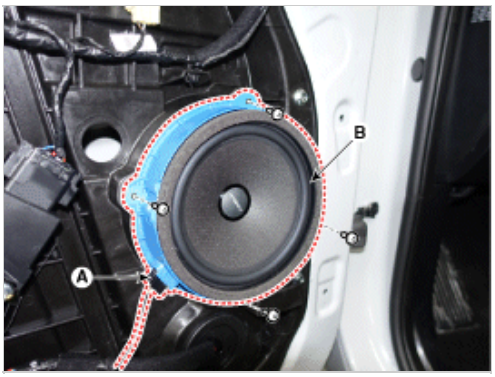
– Be careful not to cover water and oil over the speaker.

– Caution during dealing of speaker because the material of diaphragm is paper which is easy to be torn by impact and external force.
– When modifying audio system as customer pleases, this does electric damage to speaker.
– And, in this case the speakers are not covered by the manufacturer's warranty.

- Removal

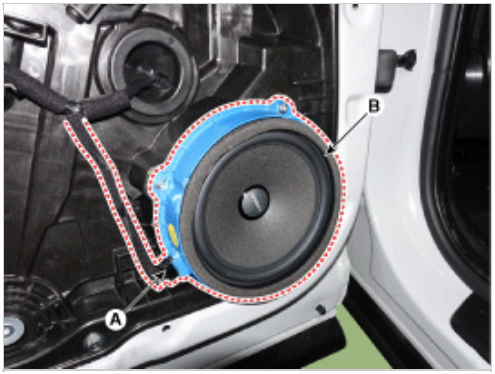
Front Door Speaker

1. Remove the front door trim.
   (Refer to Body - "Front Door Trim")
2. Disconnect the speaker connector (A).
3. Remove the front speaker (B) after loosening the screws.



Rear Door Speaker

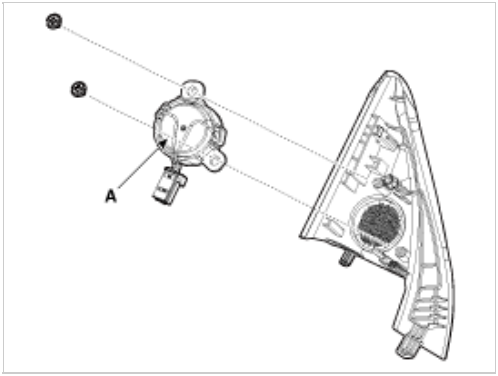
1. Remove the rear door trim.
   (Refer to Body - "Rear Door Trim")
2. Disconnect the speaker connector (A).
3. Remove the rear speaker (B) after loosening the screws.



Tweeter Speaker (Front)

1. Using a screwdriver or remover, remove the front door quadrant inner cover (A).

2. Loosen mounting screws and then Remove the tweeter speaker (A) by disconnecting the speaker connector.



- Installation

Front Speaker

1. Install the front speaker.
2. Install the front door trim.

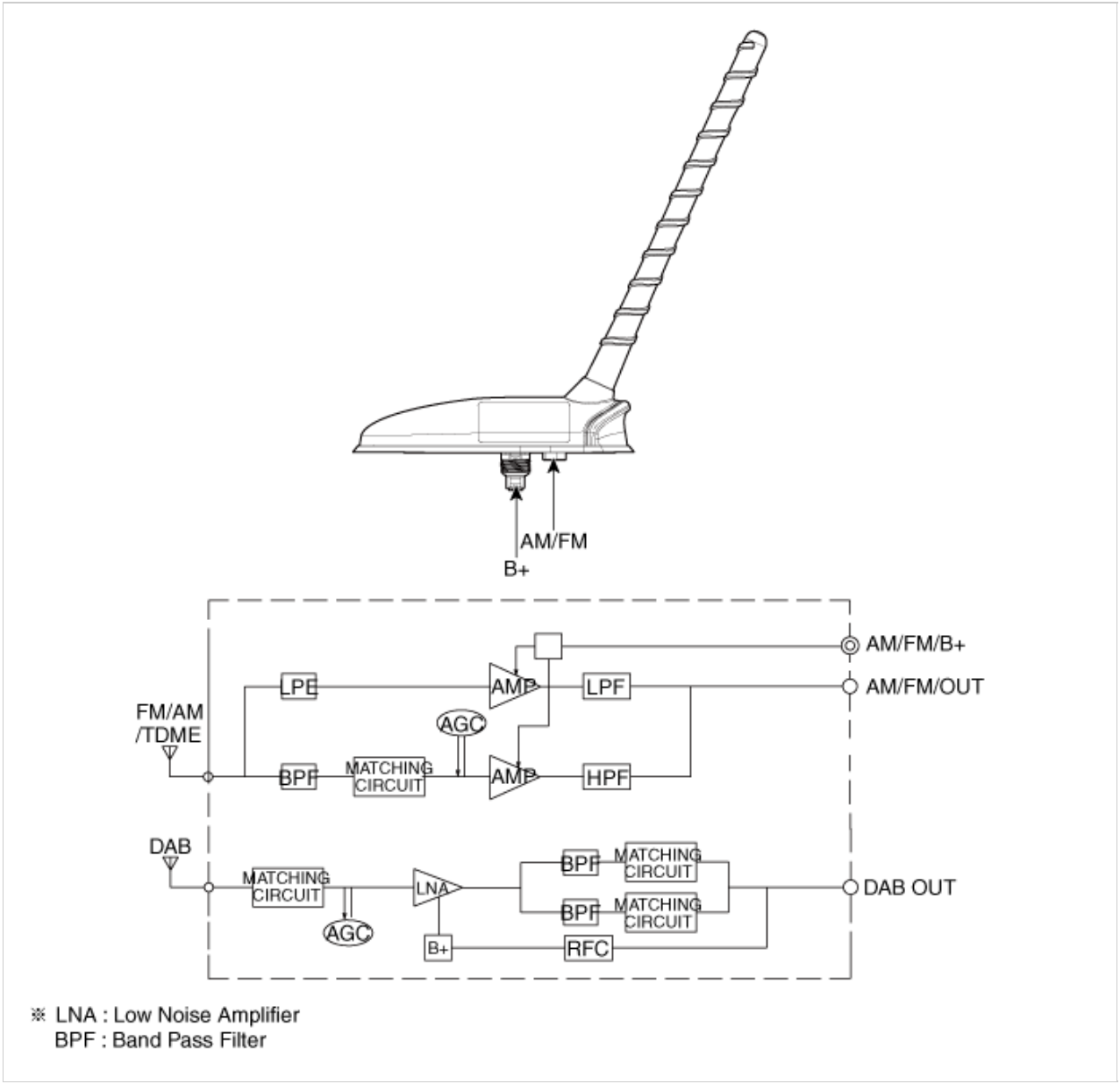
Rear Speaker

1. Install the rear speaker.
2. Install the rear door trim.

Tweeter Speaker (Front)

1. Connect the connector.
2. Install the tweeter speaker and quadrant inner cover.

- Components

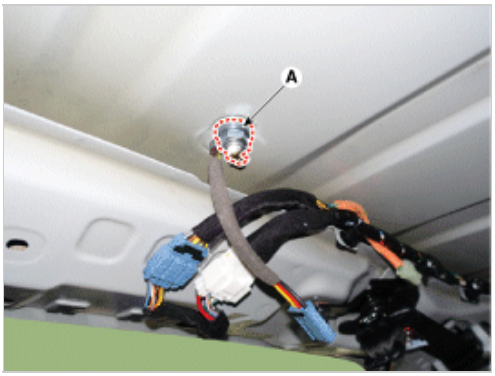


※ LNA : Low Noise Amplifier
BPF : Band Pass Filter

- Removal

1. Remove the roof trim assembly.
   (Refer to Body - "Roof Trim Assembly")
2. Disconnect the antenna connector (A).

3. Loosen the mounting nut (A) and then remove the roof antenna.

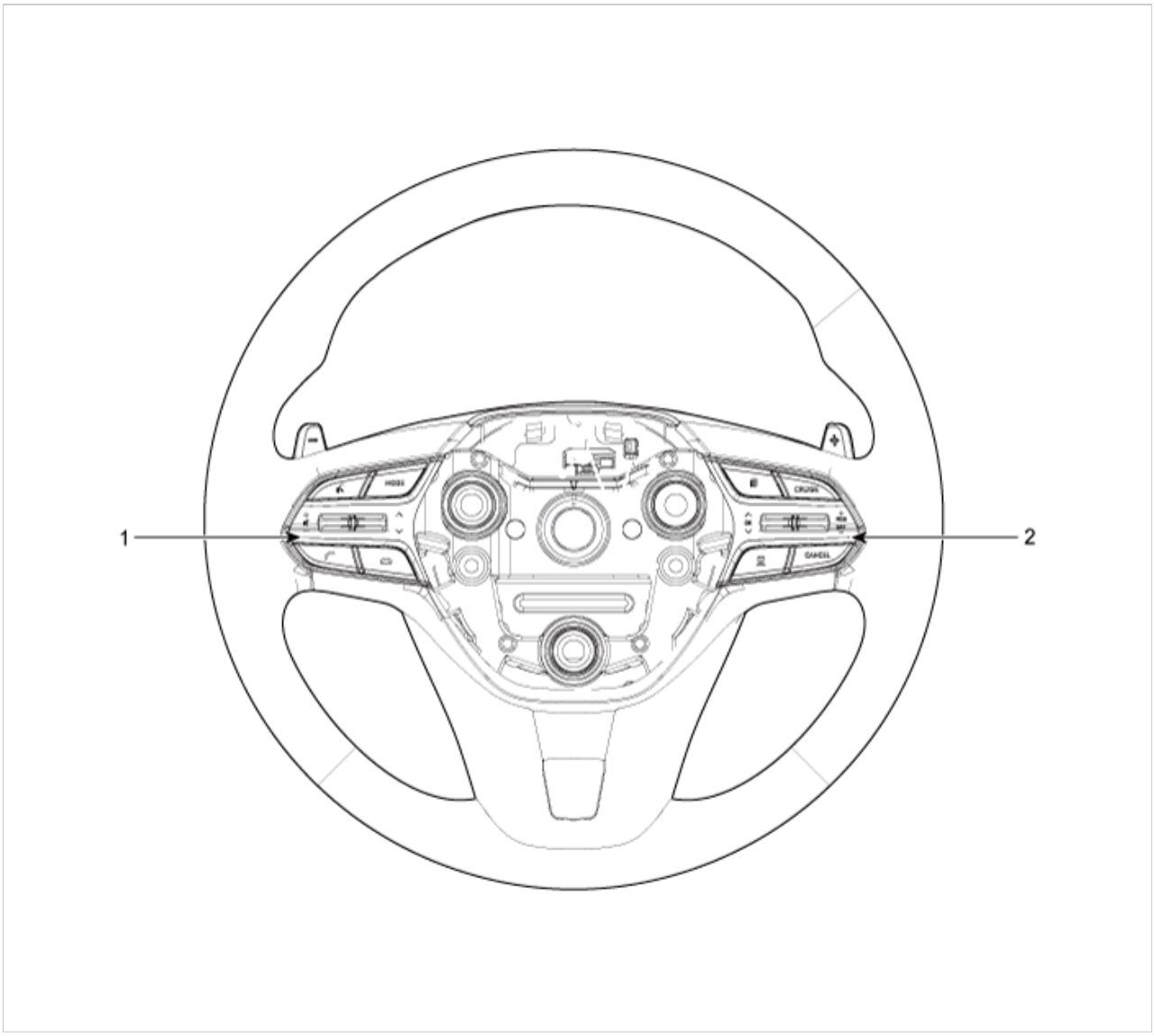


- Installation

1. Connect the roof antenna connectors and install the roof antenna.
2. Install the roof trim assembly.

> **NOTICE**
>
> • Make sure that the cables and connectors are plugged in properly.
> • Check the audio system.

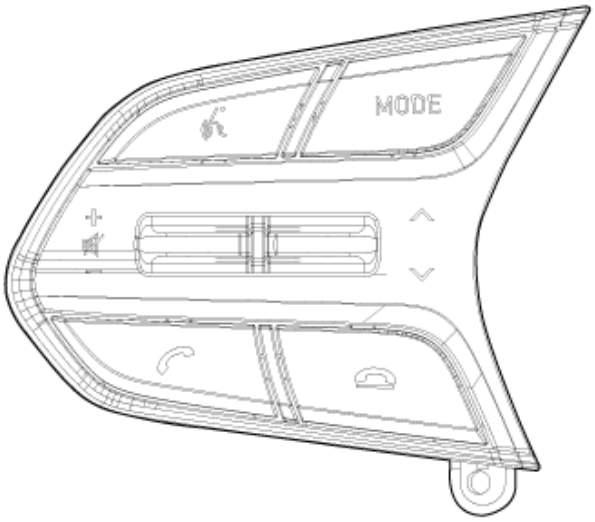
- Components

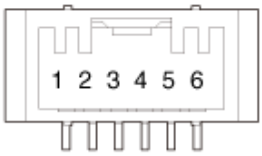


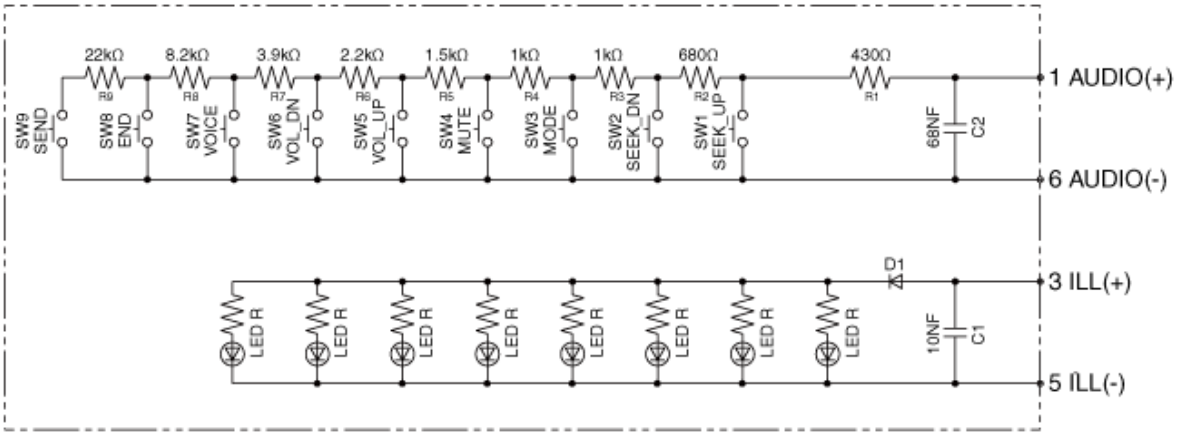
1. Remote control switch (LH : Audio + Voice)
2. Remote control switch (RH : Trip + Cruise)

- Circuit Diagram

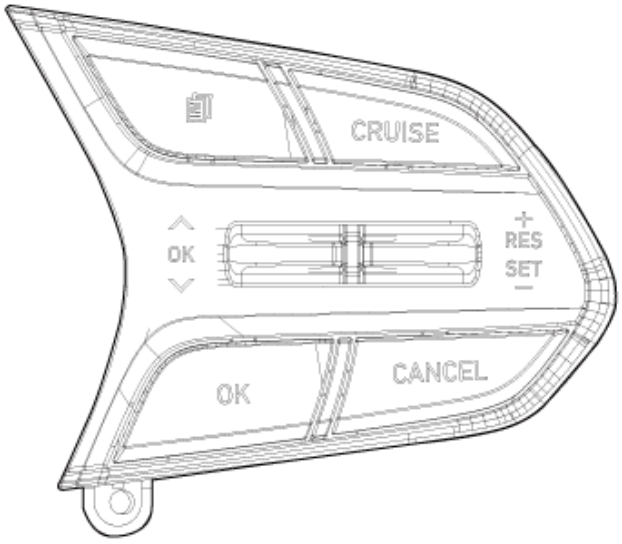
[Audio / Bluetooth / Voice]



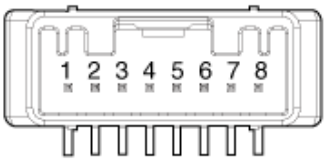
Connector	
	
No.	Description
1	Audio switch (+)
2	-
3	Illumination (+)
4	-
5	Illumination (-)
6	Audio switch (-)



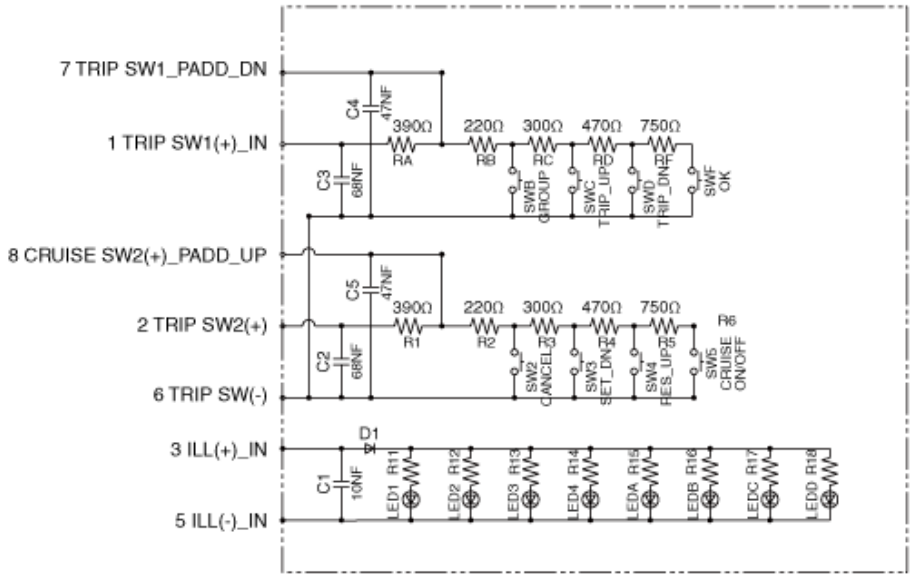
[Trip + Cruise]



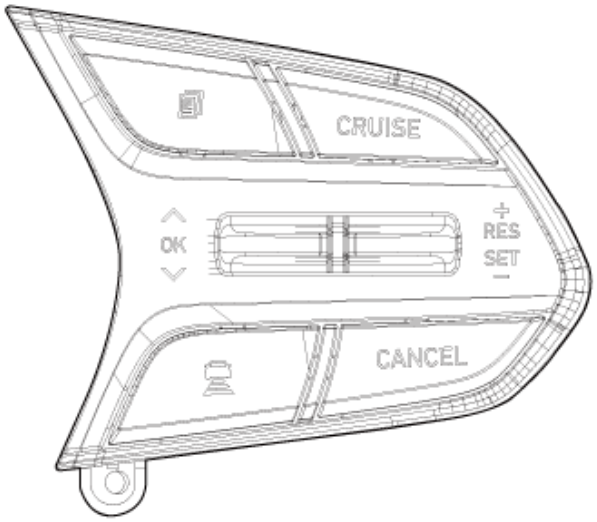
Connector

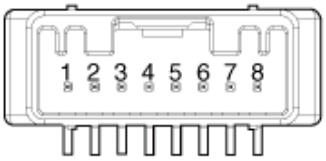


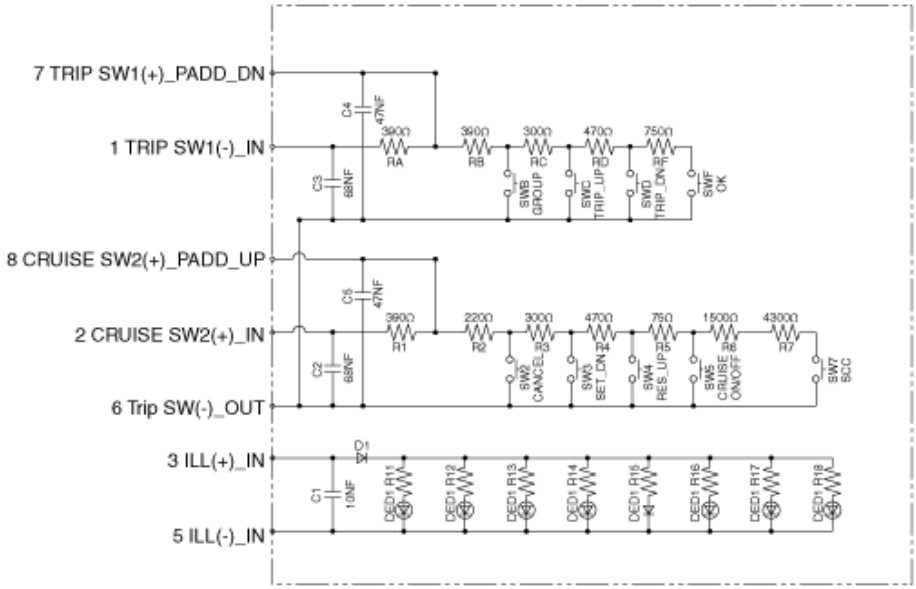
Pin	Description
1	Trip switch1 (+)
2	Trip switch2 (+)
3	Illumination (+)
4	-
5	Illumination (-)
6	Trip switch (-)
7	Trip switch paddle (Down)
8	Trip switch paddle (Up)



[Trip + Cruise + Smart cruise]

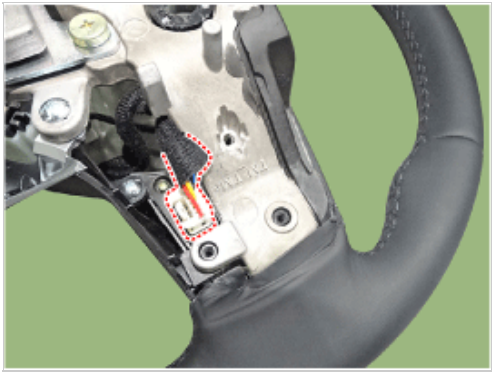


Connector	
	
Pin	Description
1	Trip switch1 (+)
2	Trip switch2 (+)
3	Illumination (+)
4	-
5	Illumination (-)
6	Trip switch (-)
7	Trip switch paddle (Down)
8	Trip switch paddle (Up)



- Inspection

1. Check for resistance between terminals in left switch position.



[Audio / Bluetooth]

Switch	Connector terminal	Resistance (± 3%)
SEEK Up	1 - 6	430 Ω
SEEK Down	1 - 6	1.1 kΩ
MODE	1 - 6	2.11 kΩ
MUTE	1 - 6	3.11 kΩ
Volume up	1 - 6	4.61 kΩ
Volume down	1 - 6	6.81 kΩ
Voice	1 - 6	10.71 kΩ
END	1 - 6	18.91 kΩ
SEND	1 - 6	40.91 kΩ

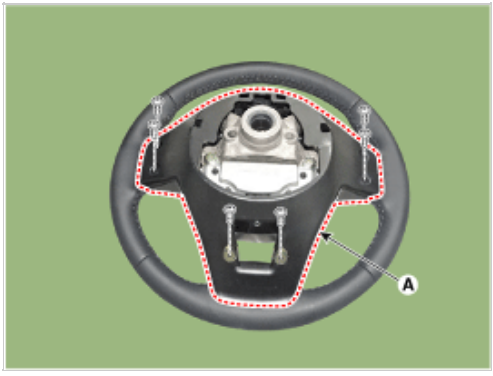
2. Check for resistance between terminals in right switch position.

[Trip / Cruise]

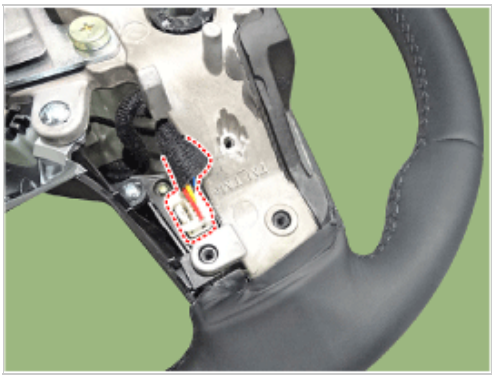
Switch	Connector terminal	Resistance (± 3%)
CANCEL	2 - 6	390 Ω
SET (-)	2 - 6	610 Ω
RES (+)	2 - 6	910 Ω
Cruise ON/OFF	2 - 6	1.38 kΩ
Cruise Mode	2 - 6	2.13 kΩ
Smart Cruise	2 - 6	3.63 kΩ
Trip Group	1 - 6	390 Ω
Trip Up	1 - 6	610 Ω
Trip Down	1 - 6	910 kΩ
Trip OK	1 - 6	1.38 kΩ

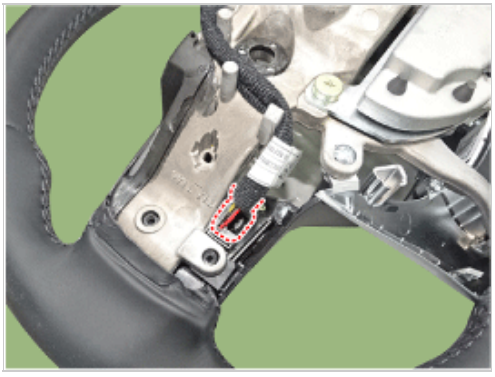
- Removal

1. Disconnect the negative (-) battery terminal.
2. Remove the driver airbag module.
   (Refer to Restraint - "Driver Airbag (DAB) Module and Clock Spring")
3. Remove the steering wheel.
   (Refer to Steering System - "Steering Column and Shaft")
4. Remove the steering wheel cover (A) after loosening the screws.

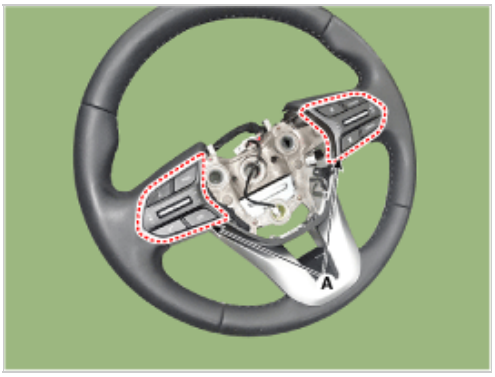


5. Loosen the screws and then disconnect the steering wheel remote control switch connector.





6. Remove the remote control switchs (A).



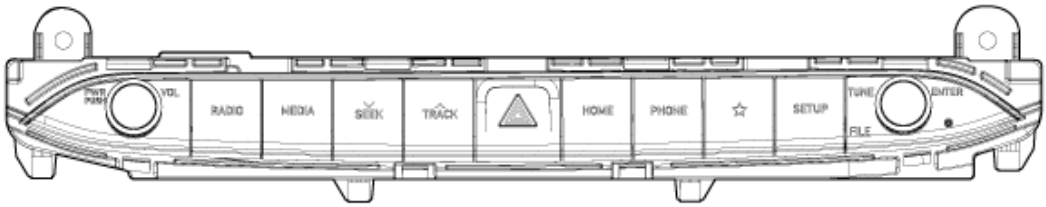
- Installation

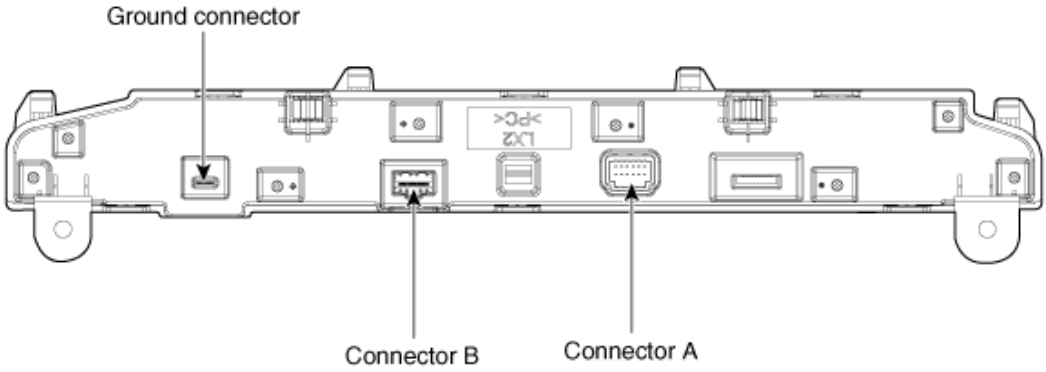
1. Install the remote control switch on the steering wheel.
2. Install the steering wheel.
3. Reconnect the remote control switch connector and airbag connectors.

> **NOTICE**
> Make sure that the switch connector is plugged in properly.

4. Install the driver airbag module.
5. Connect the negative (-) battery terminal.

- Components



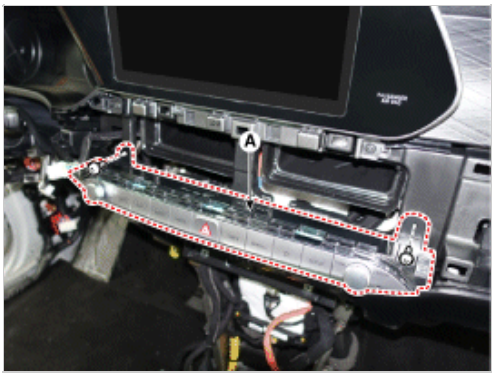


Connector A	Pin	Description	Pin	Description
	1	-	7	MM-CAN Low
	2	Battery (+)	8	MM-CAN High
	3	ACC	9	-
	4	-	10	Ground
	5	Illumination (-)	11	-
	6	Illumination (+)	12	-

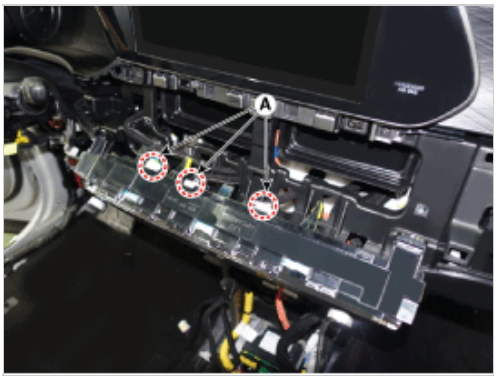
Connector B	Pin	Description	Pin	Description
	1	Battery (+)	4	Hazard switch
	2	Hazard indcator	5	-
	3	Ground	6	-

- Removal

1. Disconnct the negative (-) battery terminal.
2. Remove the carsh pad garnish.
   (Refer to Body - "Crash Pad Garnish")
3. Remove the audio keyboard unit (A) after loosening mounting screws.



4. Dsiconnect the connector (A) and then remove the AVN keyboard unit.



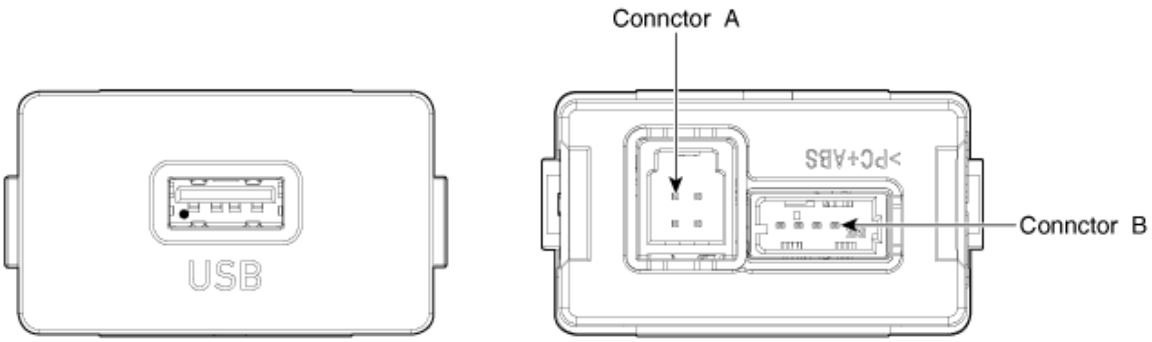
- Installation

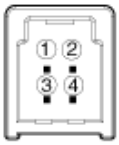
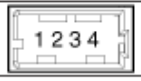
1. Install the audio keyboard unit.
2. Install the carsh pad garnish.
3. Connect the negative (-) battery terminal.

NOTICE

- Make sure the connector are connected in properly.
- Check the audio system.

- Circuit Diagram

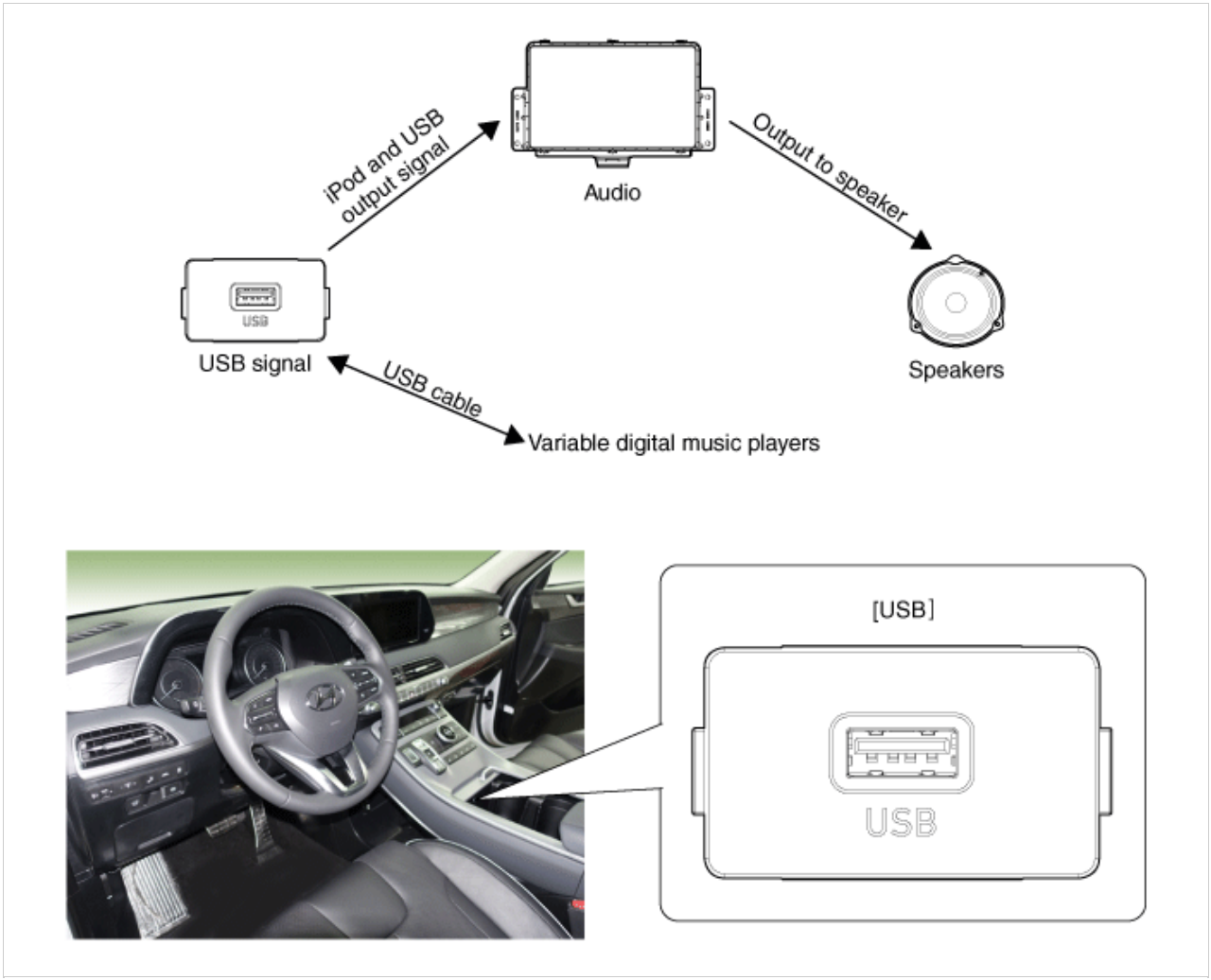


Connctor A	Pin	Description		
	1	Illumination (-)		
	2	DTC		
	3	Illumination (+)		
	4	Ground		
Connctor B	Pin	Description	Pin	Description
	1	USB_Power	3	USB_DATA (High)
	2	USB_DATA (Low)	4	USB_Ground

- Description

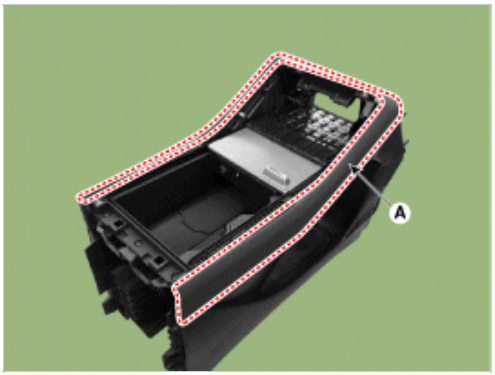
The AUX, iPod and USB JACK on the center console is for customers who like to listen to external portable music players like the MP3, iPod, earphone, USB memory stick, CD player and etc., through the vehicle's sound system when it is linked to this jack.

If sound distortion occurs it may be due to a mismatch of specifications between units.



- Removal

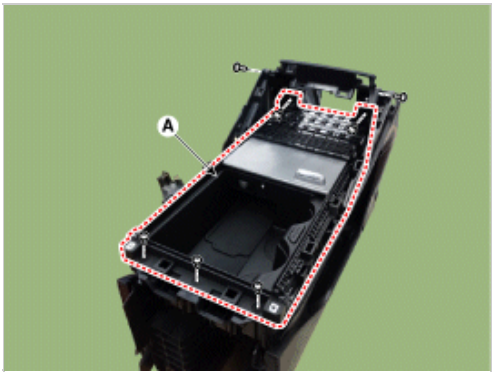
1. Disconnect the negative (-) battery terminal.
2. Remove the front console assembly.
   (Refer to Body - Floor Console Assembly")
3. Remove the front console garnish (A).



⚠ CAUTION

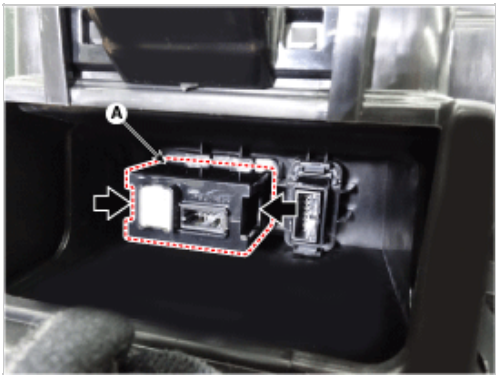
- When removing with a flat-tip screwdriver or remover, wrap protective tape around the tools to prevent damage to components.

4. Remove the front console tray assembly (A).



5. Disconnect the connector (A).

6. Remove the USB (A) by pushing the fixed clip in the direction of the arrow as lillustration below.



- Installation

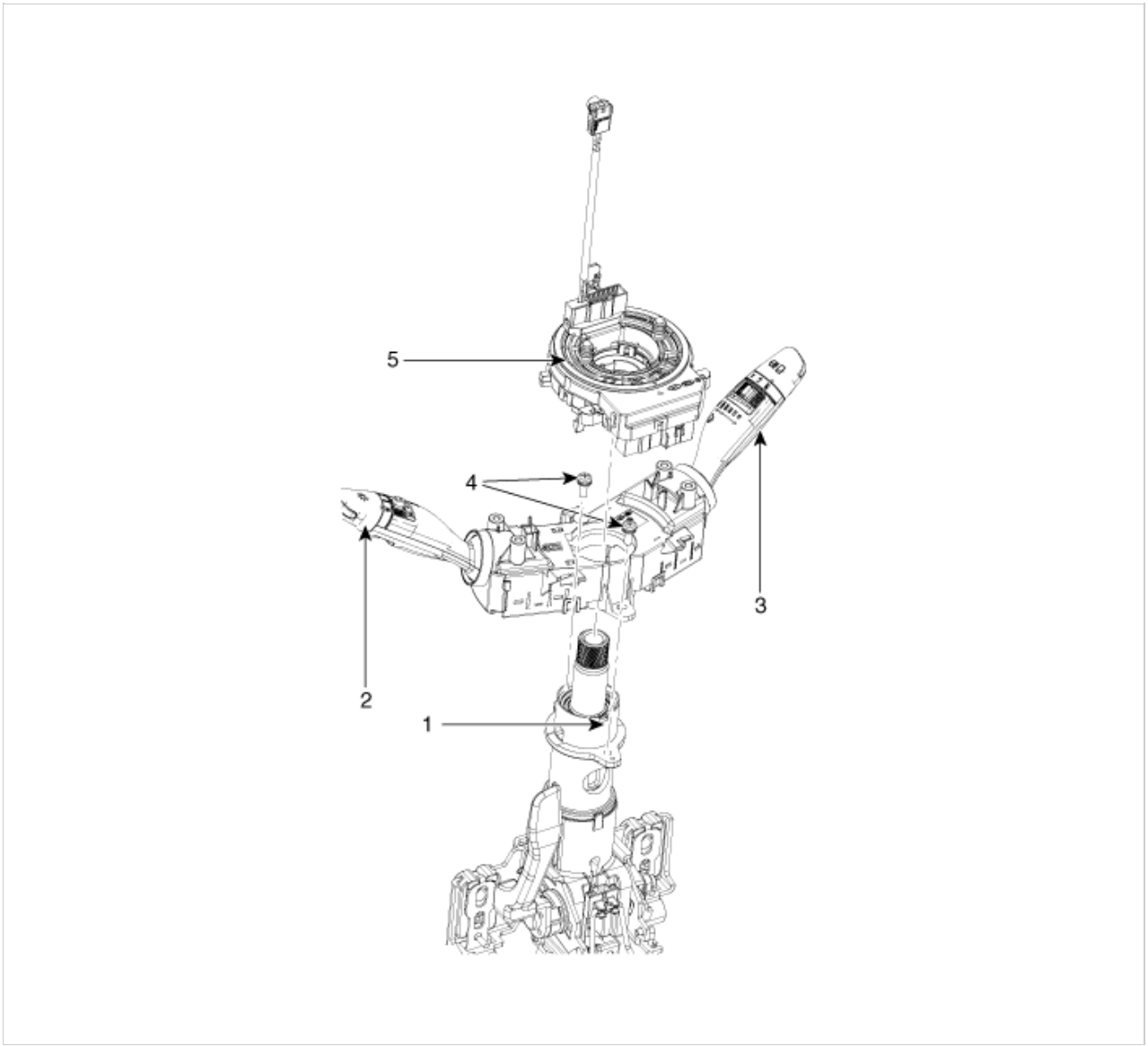
1. Install the USB.
2. Install the front console assembly.
3. Connect the negative (-) battery connector.

- Specifications

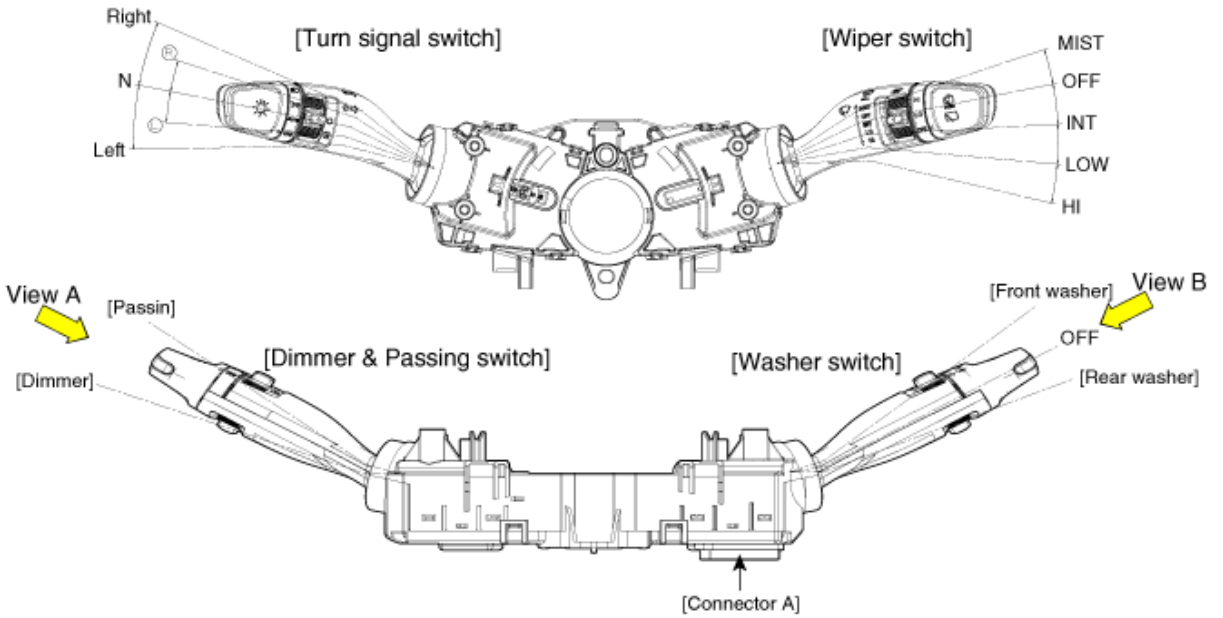
Items		Specifications
Rated voltage		DC 12V
Operating temperature range		-22 to +176°F (-30°C to +80°C)
	Dimmer & passing switch	High : 0.2A (Relay load) Low : 0.2A (Relay load) Passing : 0.2A (Relay load)
	Lighting switch	Lighting : 0.2A (Relay load) (High, Low, Auto)
	Fog lamp switch	0.2A (Relay load)

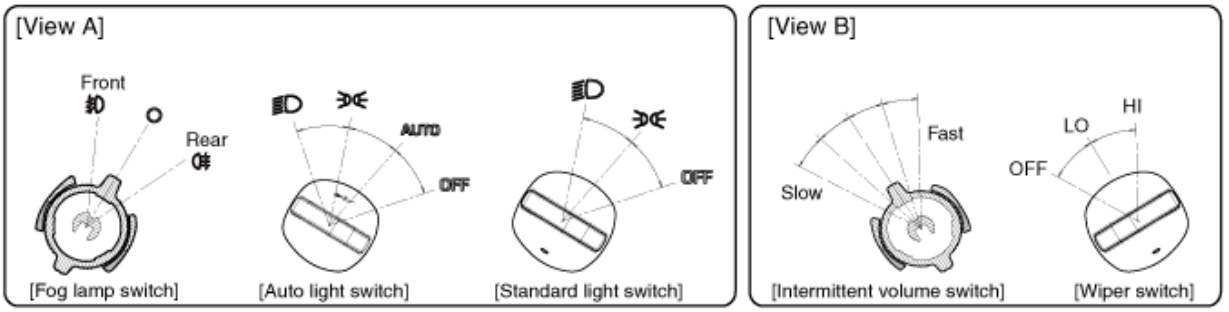
Rated load	Turn signal switch	6.6A (Lamp load)
	Wiper & mist switch	Low : 4.5A (Motor load) High : 4.5A (Motor load) Intermittent : 0.25 mA Lock : Max. 28A (Motor load) Washer : 4.0A (Motor load)
	Rear wiper & washer	Wiper : 1.0A (Relay load) Washer : 4.0A (Motor load)

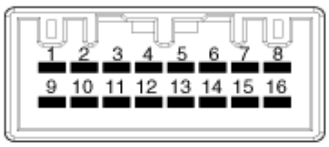
- Component



1. Steering column
2. Light switch
3. Wiper
4. Screw
5. Clock spring

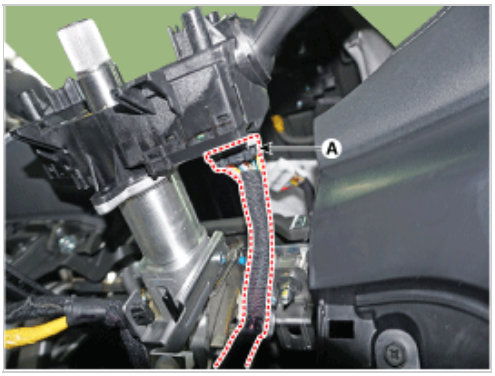




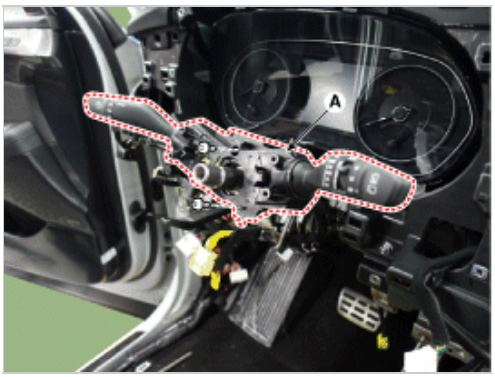
Connector A (LHD)	Pin	Description	Pin	Description
	1	Front wiper switch signal	9	Ground
	2	Front wiper low back up signal	10	Fog lamp switch signal
	3	-	11	Ground
	4	Rear washer motor switch power	12	Turn signal switch
	5	-	13	Head lamp Passing/High beam switch
	6	Front washer motor switch	14	Light switch
	7	Front wiper INT voume contact signal	15	Head lamp low back up signal
	8	Ignition 2	16	Rear wiper switch signal

- Removal

1. Disconnect the negative (-) battery terminal.
2. Remove the steering wheel.
   (Refer to Steering System - "Steering Wheel")
3. Remove the steering column upper and lower shrouds.
   (Refer to Body - "Steering Column Shroud Panel")
4. Remove the clock spring.
   (Refer to Retraint - "Driver Airbag (DAB) Module and Clock Spring)
5. Disconnect the multifunction switch connector (A).



6. Loosen the screws (2EA) and then remove the multifunction switch assembly (A).



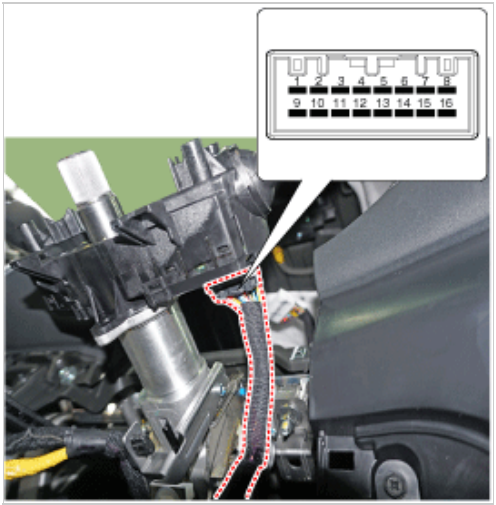
- Installation

1. Install the multifunction switch.
2. Install the clock spring and steering wheel.
3. Install the steering column upper and lower shrouds.
4. Install the steering wheel.

- Inspection

Multifunction Switch Inspection

1. Check for continuity between the terminals in each switch position as shown below.

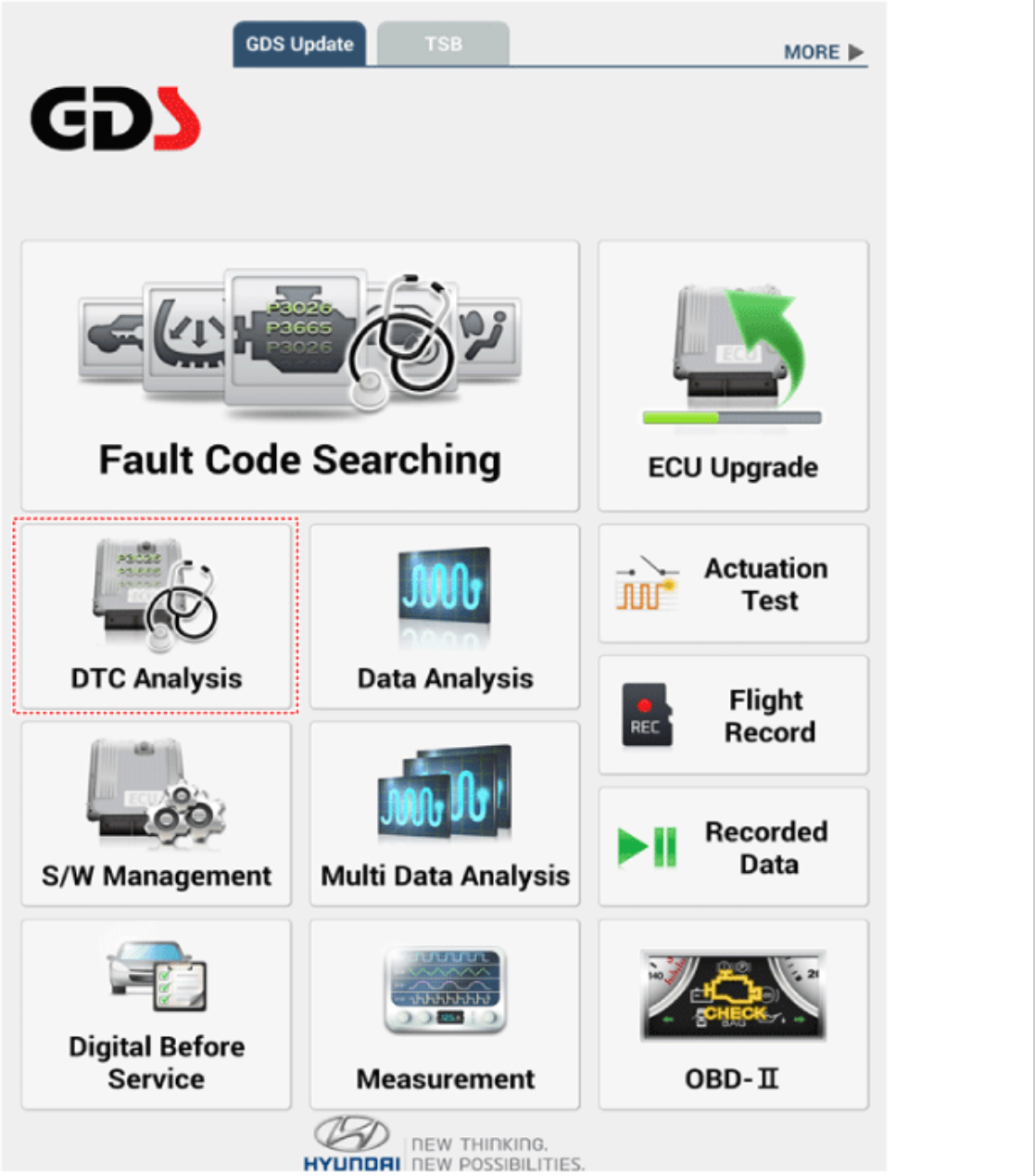


Switch	Switch position	Switch terminal	Resistance (Ω, ±3.5%)
Front wiper switch	MIST	1-9	330
	OFF		∞
	INT (AUTO)		800
	LOW		1800

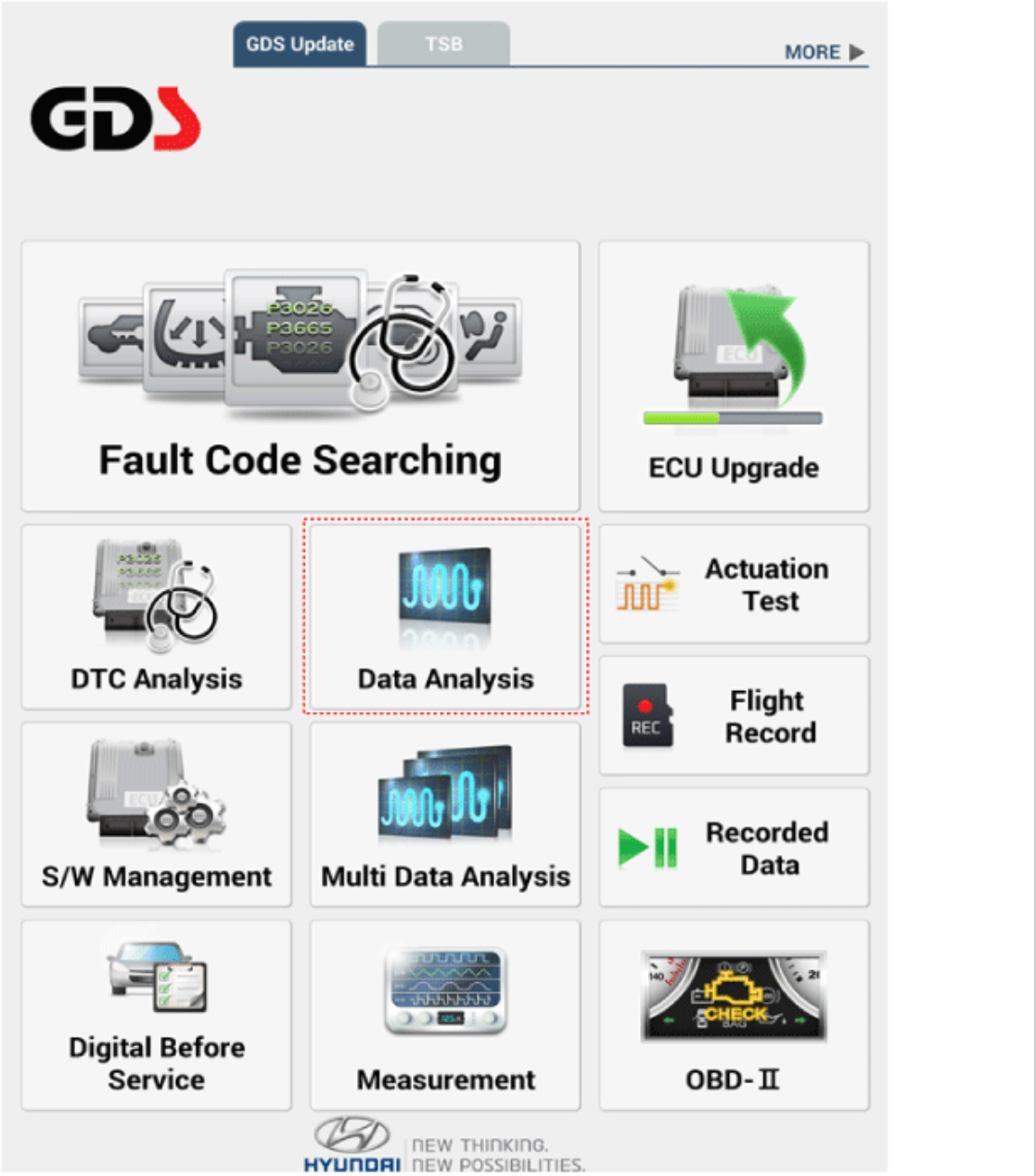
	HIGH		5700
Front wiper intermittent volume	Volume 1	7-9	330
	Volume 2		690
	Volume 3		1310
	Volume 4		2610
	Volume 5		7310
Rear wiper switch	OFF	4-16	∞
	LOW		910
	HIGH		2910
Fog lamp switch	OFF	9-10	∞
	Front foglamp		910
	Rear foglamp		2910
Turn signal switch	OFF	9-12	∞
	Left		910
	Right		2910
Dimmer & Passing switch	OFF	9-13	∞
	Passing		910
	Dimmer		2910
Light switgh	OFF	9-14	680
	AUTO / DRL		∞
	Tail lamp		1680
	Low beam		5580

Inspection (With Diagnostic tool)

1. In the body electrical system, failure can be quickly diagnosed by using the vehicle diagnostic system (Diagnostic tool).
   The diagnostic system (Diagnostic tool) provides the following information.
   (1) Fault Code Searching : Checking failure and code number (DTC)
   (2) Data Analysis : Checking the system input/output data state
   (3) Actuation test : Checking the system operation condition
   (4) S/W Management : Controlling other features including system option setting and zero point adjustment
2. If diagnose the vehicle by Diagnostic tool, select "DTC Analysis" and "Vehicle".

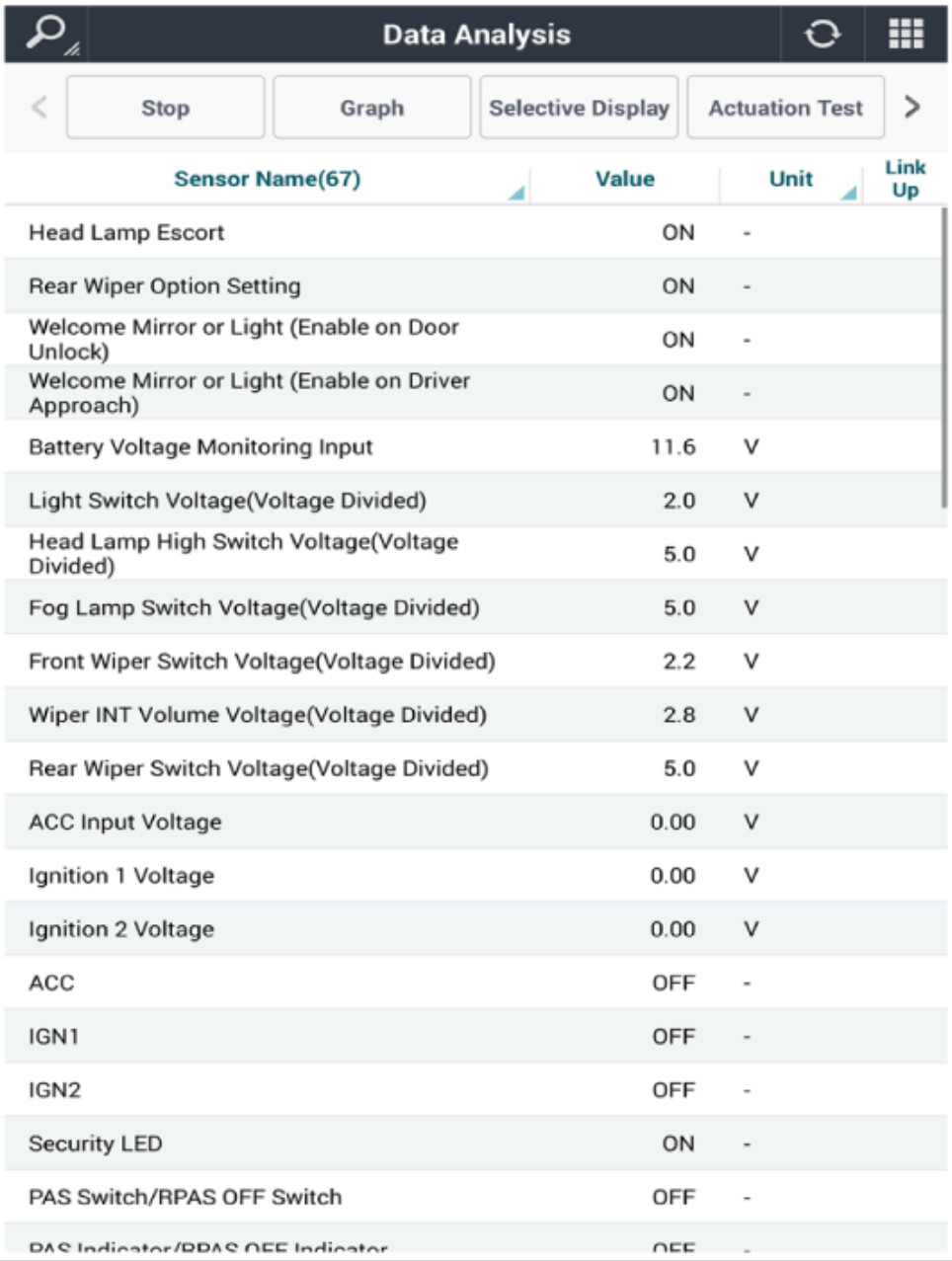


3. If check current status, select the "Data Analysis" and "Car model".



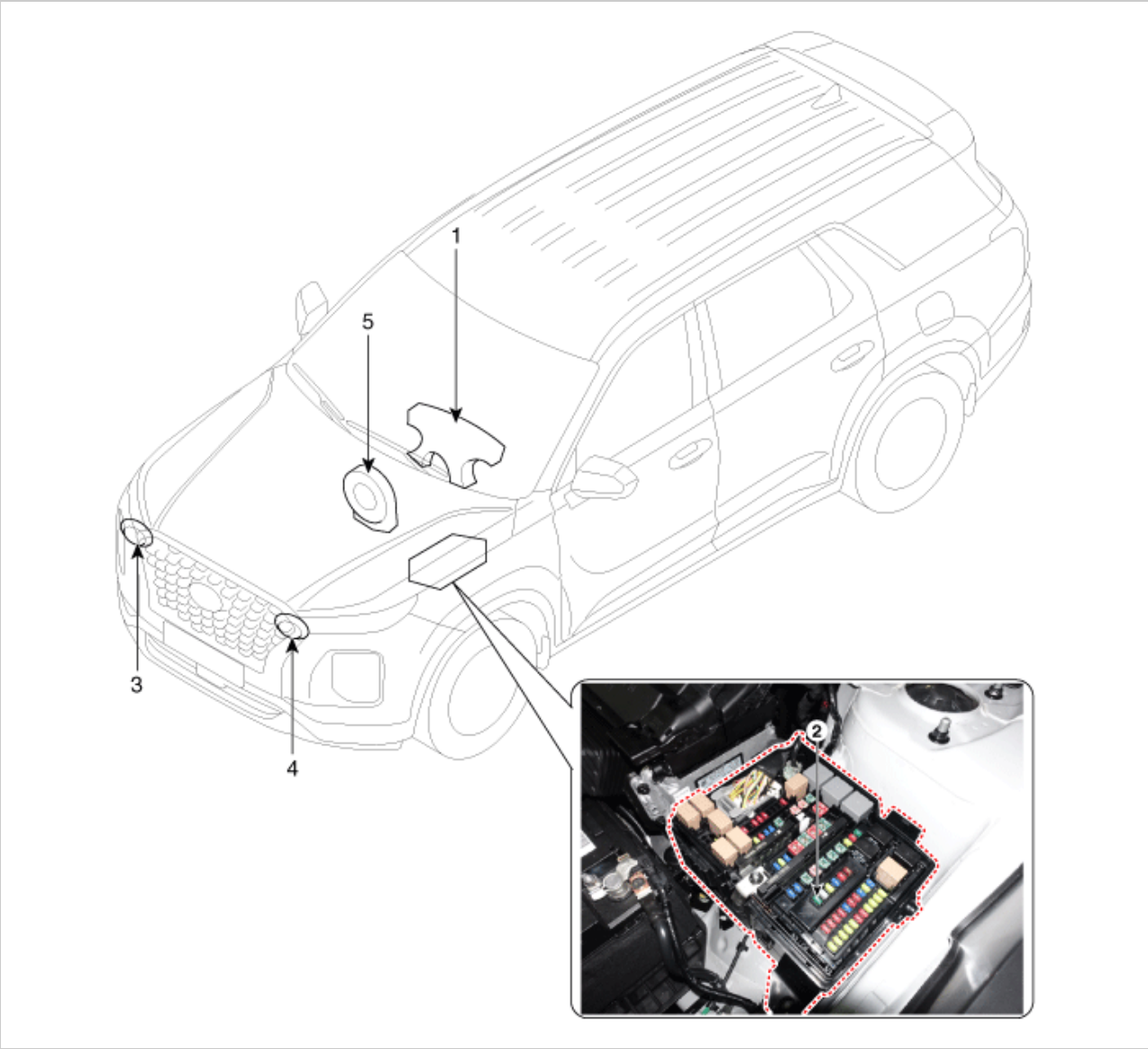
4. Select the 'IBU_BCM' to search the current state of the input/output data.

Vehicle Selection
PREV
AUTO VIN
RESET
SANTAFE(SM)
SANTAMO(M2)
D 2.2 TCI-R
System Selection
ENGINE
A / T
ABS/ESP
FCA
AIRBAG
AIRCON
4WD
EPS
RVM
SVMS
PA
BCW
FR_CMR
AFLS
AHLS
AVN
CLU
DDM
80km/h
HUD
IBU-BCM
IBU-IMMO
IBU-SMK
IBU-TPMS
PSM
System
IBU-BCM
OK



Sensor Name(67)	Value	Unit	Link Up
Head Lamp Escort	ON	-	
Rear Wiper Option Setting	ON	-	
Welcome Mirror or Light (Enable on Door Unlock)	ON	-	
Welcome Mirror or Light (Enable on Driver Approach)	ON	-	
Battery Voltage Monitoring Input	11.6	V	
Light Switch Voltage(Voltage Divided)	2.0	V	
Head Lamp High Switch Voltage(Voltage Divided)	5.0	V	
Fog Lamp Switch Voltage(Voltage Divided)	5.0	V	
Front Wiper Switch Voltage(Voltage Divided)	2.2	V	
Wiper INT Volume Voltage(Voltage Divided)	2.8	V	
Rear Wiper Switch Voltage(Voltage Divided)	5.0	V	
ACC Input Voltage	0.00	V	
Ignition 1 Voltage	0.00	V	
Ignition 2 Voltage	0.00	V	
ACC	OFF	-	
IGN1	OFF	-	
IGN2	OFF	-	
Security LED	ON	-	
PAS Switch/RPAS OFF Switch	OFF	-	
PAS Indicator/RPAS OFF Indicator	OFF	-	

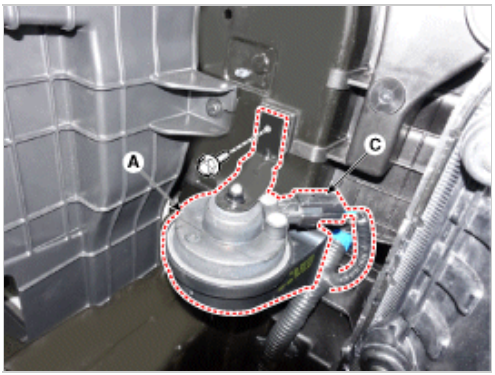
- Component Location

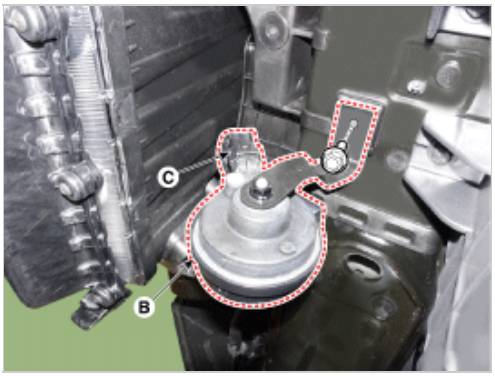


1. Horn switch
2. Horn relay (Engine room compartment)
3. Horn (Low pitch)
4. Horn (High pitch)
5. Clock spring

- Removal

1. Remove the front bumper cover.
   (Refer to Body - "Front Bumper Cover")
2. Remove the bolts and disconnect the horn connectors (C), then remove the high pitch horn (B) and low pitch horn (A).





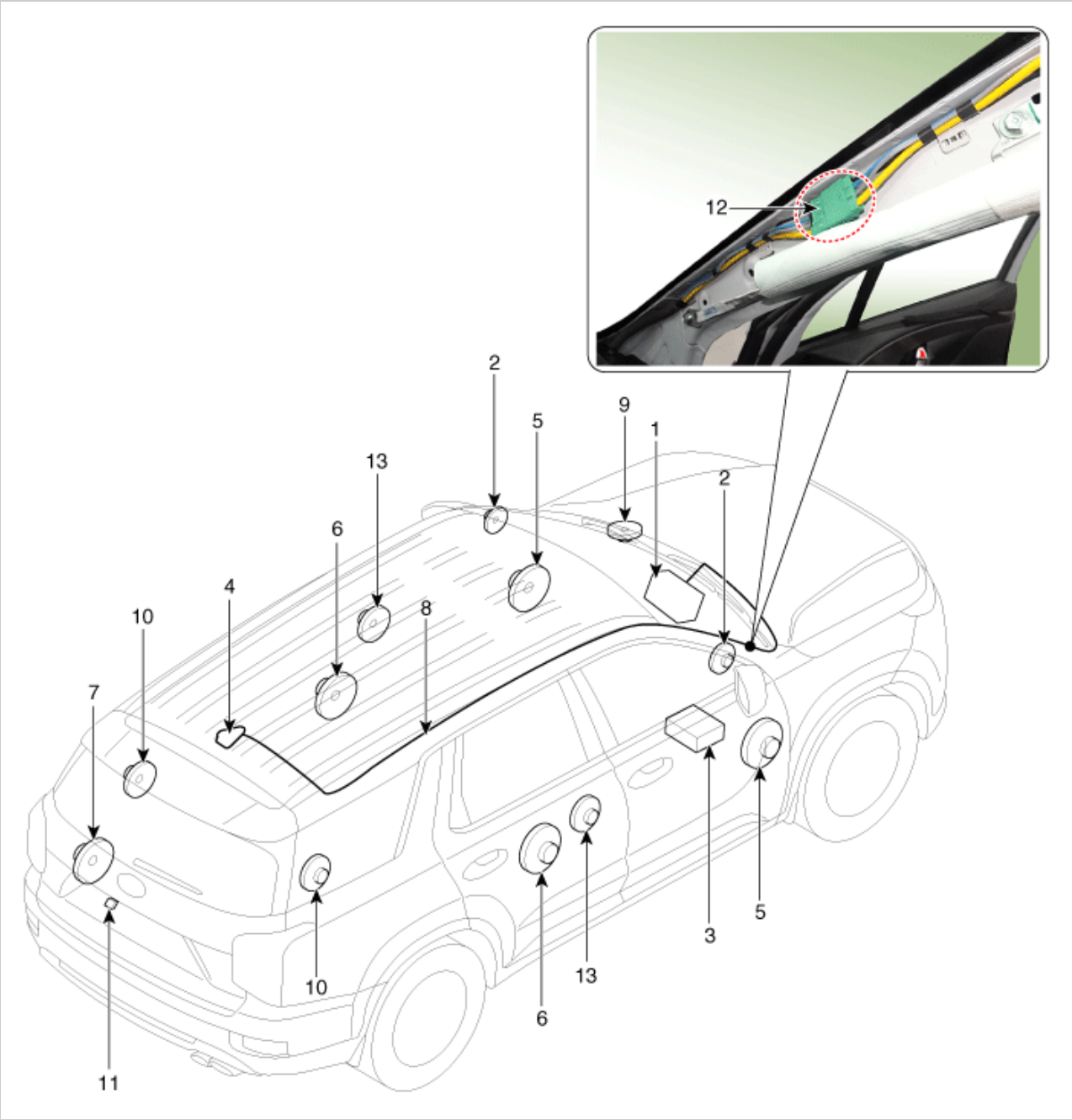
- Installation

1. Install the horns after connecting the horn connectors.
2. Install the front bumper cover.

- Specifications

Item	Specification
Power source	DC 14.4V (-) ground
Frequency range / Channel space	FM : 87.5 - 108.0 MHz / 100 KHz AM : 531 - 1602 KHz / 9 KHz
Tuning type	PLL SYNTHESIZED TUNING
Impedance	2 ohm x 4
Antenna	80 pF 75 ohm
parastic current	Within 45 days, an average of less than 1mA is managed
S/N	FM : MIN 50 dB AM : MIN 45 dB

- Components Location



1. AVN (A/V & Navigation head unit)
2. Front tweeter speaker
3. External amplifier
4. Roof antenna
5. Front door speaker
6. Rear door speaker
7. Subwoofer speaker
8. Antenna feeder cable
9. Front center speaker
10. Surround speaker
11. Rear view monitor
12. Feeder cable joint connector
13. Rear tweeter speaker

- Description

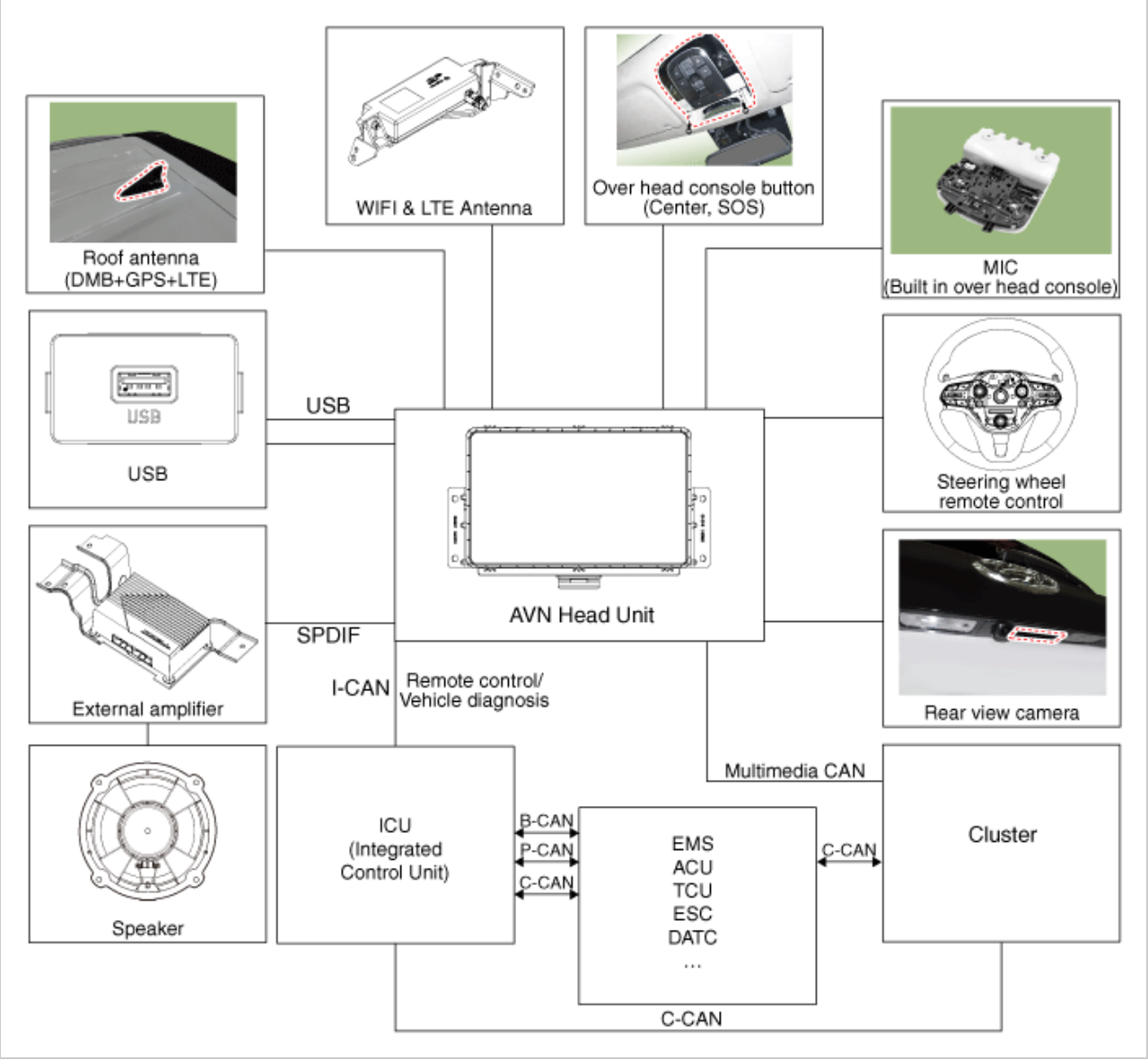
AVN system

The AVN system has improved information search and easiness of manipulation for the driver by simplifying the system operation experience and unifying the display of the user information such as multimedia and car information.

The system is basically composed of a keyboard for the operation of combined function, LCD monitor, a head unit with Bluetooth handsfree calling, voice recognition and navigation, music amplifier and the media unit that connects with other outside devices.

1. Simplification of user interface : the multimedia and car information are displayed on the monitor.
2. Networked electronic parts : Efficient information transmission through CAN communications.
3. Up-to-date technologies integrated :
   - Voice recognition : This function recognizes the user's voice commands to manipulate the system. The user can issue voice commands to operate AV system, Bluetooth phone and navigation and connect to Cubis call center.
   - Bluetooth hands-free calling : This is compliant with the international wireless communication standards and uses bluetooth technology adopted in most currently launched mobile phones. Once connected, it is automatically linked to the driver's cell phone whenever the driver gets in the car.
   - USB/iPod connectivity : External music devices like iPod, USB memory stick, Walkman are connected and played through the car speakers. iPod can be operated using the integrated keyboard.

System Block Diagram



- B-CAN : Body Controller Area Network
- MM-CAN : Multi-Media Controller Area Network

Limitations Of The Navigation system

GPS Signal Reception State

As the GPS satellite frequency is received/transmitted in straight lines, reception may not work if hiding devices are placed on or near the GPS antenna or when traveling through the following locations.

- Tunnels

- Basement parking structures
- Underneath an overpass
- Roads within forested areas
- Areas near high rise buildings
- Roads within canyons

Vehicle Position Display

1. If multipass errors occur due to reflections from buildings or related causes, the current position mark on the navigation may differ from the actual position of the vehicle.
2. The position of the vehicle on the navigation may be different from the actual position if the vehicle is under the occur, driving for a short period of time will vehicle through map matching or GPS information (several minutes may be necessary in certain cases).
   - When driving on a Y-shaped road with a narrow angle, the current position may be displayed in the opposite direction.
   - If the vehicle is loaded onto a car transport vehicle, the current position mark may be stalled on the last position prior to loading.
   - When driving on a spiral-shaped road.
   - When driving in mountain regions with sharp turns or sudden brakes.
   - When entering a road after having been in an underground parking structure, building parking structure, or turnable with many rotations.
   - When the tires have recently been replaced (Especially upon use of spare or studless tires)
   - If the battery terminal is removed.
   - When driving in city streets, the current position may be displayed on the opposite side or on an off-road position.
   - When changing the zoom level from the maximum zoom in level to a different zoom level, the current position mark may be displayed on a different road.
   - When driving in heavy traffic with frequent go · stops in traffic or intersections.
   - When driving under slippery conditions, such as heavy sand, snow, etc.
   - When driving with the tire chain in place.
   - When using a tire with an incorrect size specification.
   - When the tire pressure for the 4 tires are different.
   - When the replacement tire is a worn or used tire (Especially studless tires having passed a 2nd seasons, etc.)
   - When driving near high-rise buildings
   - If a roof carrier has been installed
   - When driving under high speeds or having calculated a long-distance route.

Route Guidance

Suitable route guidance may not occur caused by search conditions or the driving position.

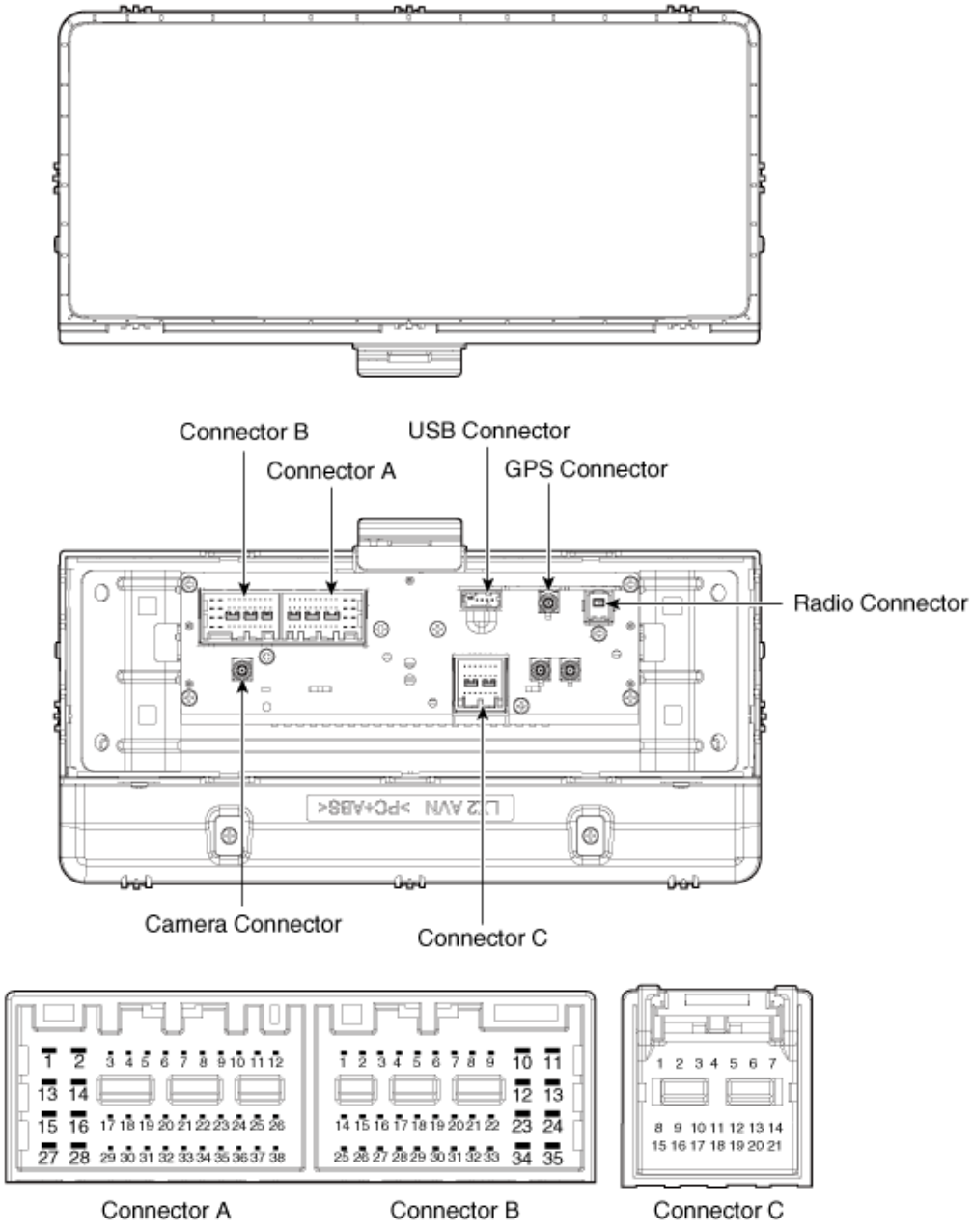
- Guidance to go straight may be given while driving on a straight road.
- Guidance may not be given even when having turned at an intersection.
- There are certain intersections in which guidance may not occur.
- A route guidance signaling entrance into a no enter zone may occur (No enter zone, road under construction, etc.)
- Guidance may be given to a position removed from the actual destination if roads to reach the actual destination do not exist or are too narrow.
- Faulty voice guidance may be given if the vehicle breaks from the designated route (ex : if a turn is made at an intersection while the navigation provided guidance to go straight).
- Map Data may be missing or incorrect causing route guidance to not be given.

Route Re-calculation

The following phenomena may occur after conducting route recalculation.

- When turning at an intersection, the navigation system gives wrong information on the current position.
- Route recalculation may take a longer period of time when driving under high speeds.
- A route guidance signaling for a U-Turn in a No U-Turn location may occur.
- A route guidance signaling entrance into a no enter zone may occur (No enter zone, road under construction, etc).
- Guidance may be given to a position removed from the actual destination do not exist or are too narrow.
- Faulty voice guidance may be given if the vehicle breaks from the designated route (ex : if a turn is made at an intersection while the navigation provided guidance to go straight)

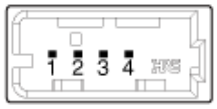
- Components

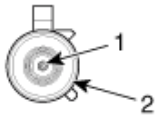


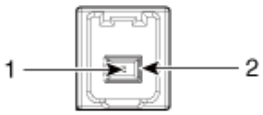
Connector Pin Information

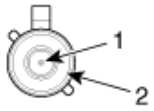
No	Connector A (ExternalAmplifier)	Connector A (Internal Amplifier)	Connector B	Connector C
1	-	Rear door speaker LH (+)	-	-
2	-	Rear door speaker LH (-)	Mic (+)	I_CAN (High)
3	Navigation voice (+)	-	-	-
4	External amplifier SPDIF (+)	-	-	-
5	Reset	Reset	Antenna dummy power	-
6	RVM : Camera Power , SVM : -	RVM : Camera Power , SVM : -	Illumination (+)	-
7	RVM : Camera Video , SVM : -	RVM : Camera Video , SVM : -	M-CAN (High)	-
8	-	-	-	-
9	-	-	-	-
10	-	-	Battery (+)	-

11	AUX DETECT	AUX DETECT	Battery (+)	-
12	Steering wheel remote	Steering wheel remote	Ground	-
13	-	Front door speaker LH (+)	Ground	-
14	-	Front door speaker LH (-)	-	-
15	-	Front door speaker RH (-)	Mic (-)	-
16	-	Front door speaker RH (+)	- (SVM type:SVM Detect2)	MTS Key
17	Navigation voice (-)	-	-	-
18	External amplifier SPDIF (-)	-	-	-
19	External amplifier SPDIF (Ground)	-	Illumination (-)	-
20	RVM : Camera Power GND , SVM : -	RVM : Camera Power GND , SVM : -	M-CAN (Low)	-
21	RVM : Camera Video GND , SVM : -	RVM : Camera Video GND , SVM : -	-	-
22	-	-	ACC	
23	-	-	Keyboard Power	
24	-	-	-	
25	-	-	-	
26	Steering wheel remote ground	Steering wheel remote ground	-	
27	-	Rear door speaker RH (-)	-	
28	-	Rear door speaker RH (+)	-	
29	-	-	-	
30	-	-	-	
31	-	-	-	
32	SVM DETECT 1	SVM DETECT 1	-	
33	RVM : Camera Shield GND , SVM : -	RVM : Camera Shield GND , SVM : -	IGN 1	
34	-	-	Keyboard GND	
35	-	-	-	
36	-	-		
37	-	-		
38	Vehicle speed	Vehicle speed		

USB antenna connector	PIN	Description	PIN	Description
	1	USB_Power	3	USB_High
	2	USB_Low	4	USB_Ground

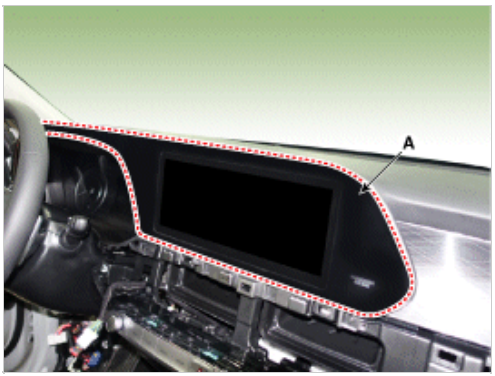
GPS antenna connector	PIN	Description	PIN	Description
	1	GPS	2	Ground

Radio antenna connector	PIN	Description	PIN	Description
	1	AM/FM	2	Ground

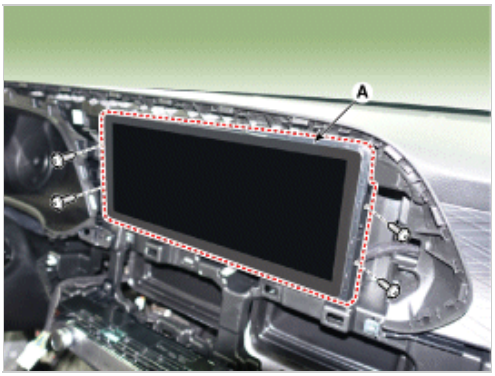
Camera Antenna Connector	PIN	Description	PIN	Description
	1	Signal	2	Ground

- Removal

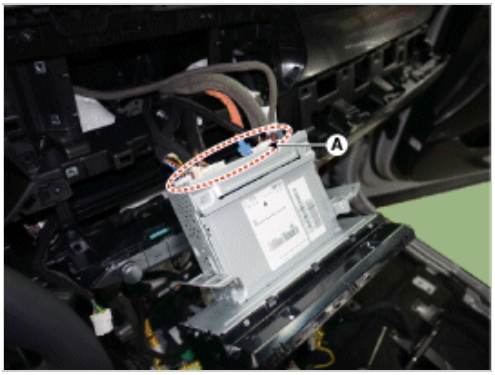
1. Disconnect the negative (-) battery terminal.
2. Remove the center fascia panel.
   (Refer to Body - "Center Fascia Panel")
3. Using a flat-head screwdriver, remove the monitor cover (A).



4. Remove the AVN head unit (A) after loosening mounting screws.



5. Remove the AVN head unit (A) after disconnecting the connectors and cable.



- Installation

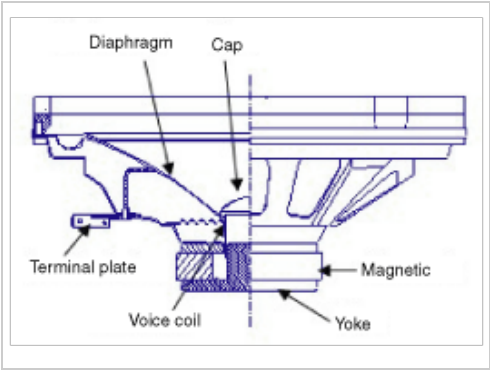
1. Connect the audio unit connectors.
2. Install the AVN head unit.
3. Install the monitor cover.
4. Install the center fascia panel.
5. Connect the negative (-) battery terminal.

NOTICE

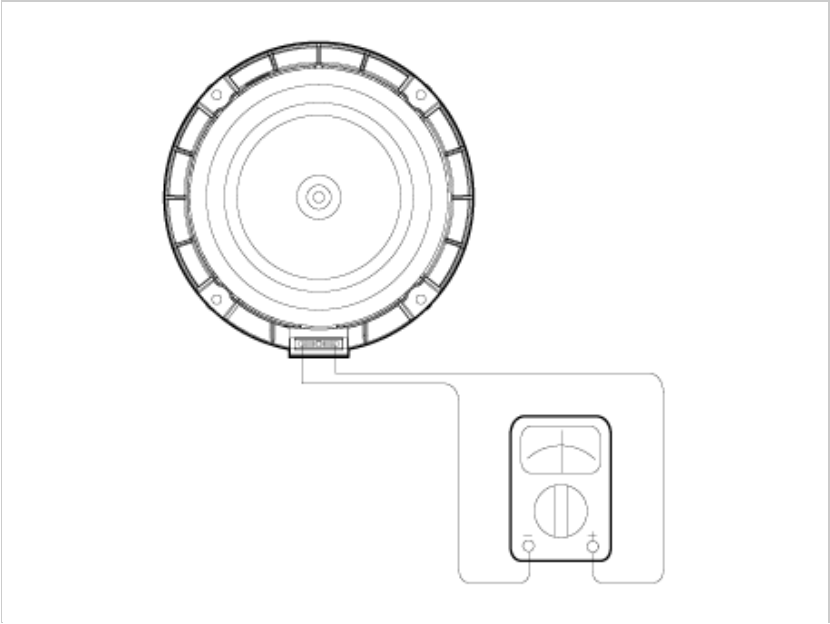
- Make sure the connector are connected in properly.
- Check the AVN system.

- Inspection

1. Troubleshooting for Speaker
   (1) Basic inspection of speaker
   Inspect the sound from speaker after verifying that the speaker mounting screws are removed and the wiring connector is connected to remove any possible vibration transmitted from body trims and surrounding parts.



(2) Case Troubleshooting

No	Case	Inspection/Remedy
1	Trembling sound	1) Before replacing the speaker, inspect that the mounting screw is installed normally. 2) After re-installing the speaker, verify that no trembling sound is heard. 3) When hearing a trembling sound again, replace the speaker with new one.
2	Noise	1) Check if the wiring connector is connected normally. If not, reconnect the wiring connector. 2) In case of radio static, check if there is a noise from CD. 3) When a noise is heard on turning radio and CD on, replace the speaker with new one. **NOTICE** • In case there is only radio static, this causes from poor radio reception. Thus the speaker needs no repair and replacement.
3	Poor working	Inspection of the wiring connection between the battery and the speaker 1) Before replacing the speaker, inspect the wiring connection between the battery and the speaker is normal. 2) Check the supply power to the speaker and the resistance, then inspect the sound quality. ■ Specified impedance : 2 - 4Ω  3) If the speaker works poorly, replace it with new one.

⚠ CAUTION

When handling the speakers:

– Do not damage the speaker with impact, like dropping or throwing it.

– Be careful not to drop water and oil on the speakers.

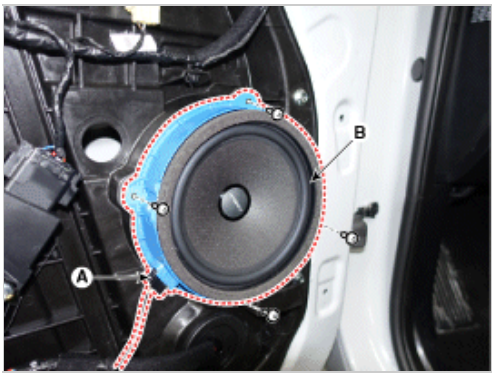
– Caution during handling of speaker because the material of diaphragm is paper which is easily torn by impact or external force.

– Modifying the audio system may cause damage the speakers. If this is the case, the speakers are not covered by the manufacturer's warranty.

- Removal

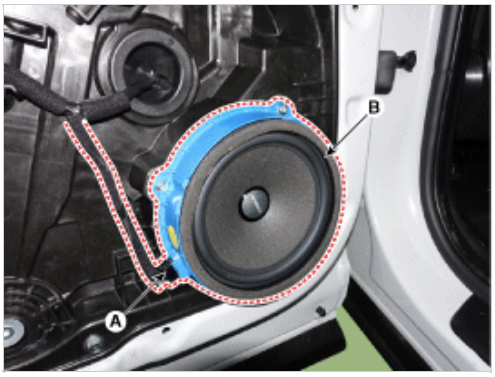
Front Door Speaker

1. Remove the front door trim.
   (Refer to Body - "Front Door Trim")
2. Disconnect the speaker connector (A) and then remove the front door speaker (B) after loosening mounting screws.



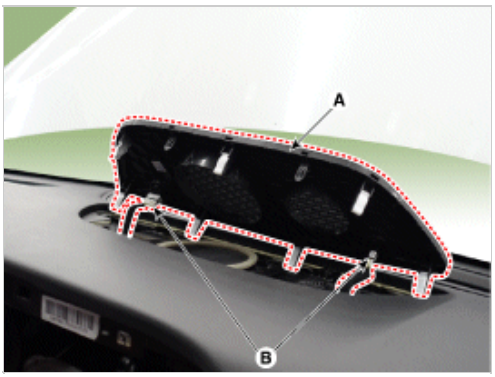
Rear Door Speaker

1. Remove the rear door trim.
   (Refer to Body - "Rear Door Trim")
2. Disconnect the speaker connector (A) and then remove the front door speaker (B) after loosening mounting screws.



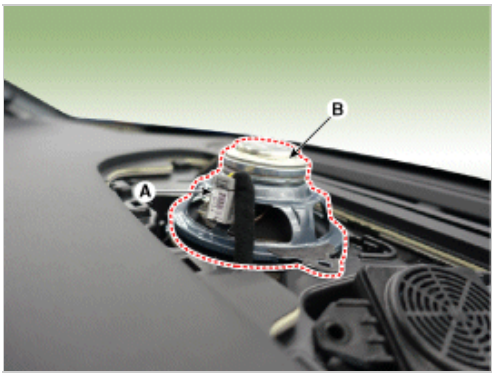
Front center speaker

1. Remove the center speaker grill (A) and then disconnect the speaker connector (B).



2. Remove the center speaker (A) after loosening mounting screws.

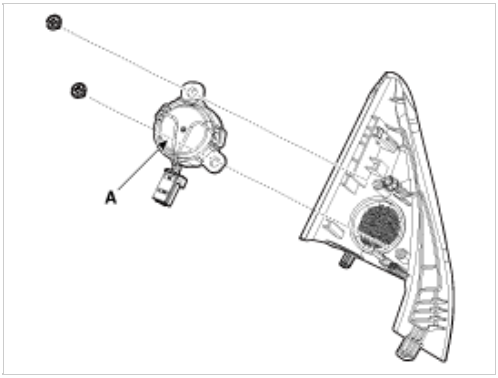
3. Disconnect the speaker connector (A) and then remove the center speaker (B).



Front Tweeter Speaker

1. Remove the front quadrant cover (A).

2. Remove the speaker (A) after loosening mounting screws.

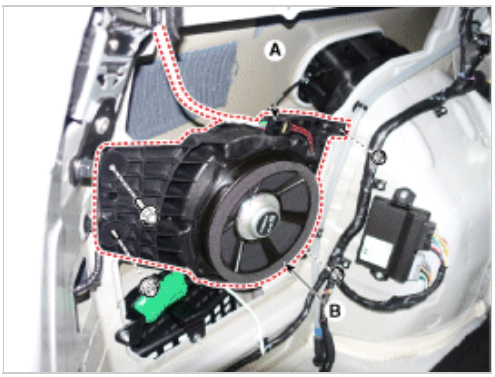


Rear Tweeter Speakers

1. Remove the rear door trim.
   (Refer to Body - "Rear Door Trim")
2. Disconnect the speaker connector and then remove the center speaker (A).

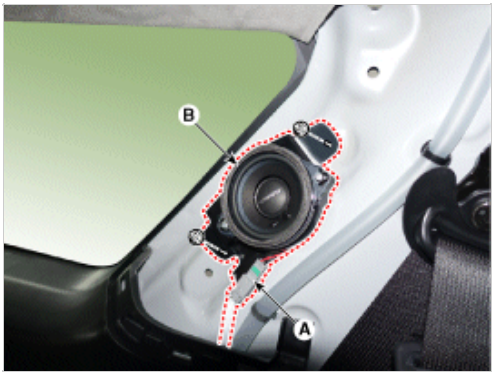
Woofer Speaker

1. Remove the rear side luggage trim LH.
   (Refer to Body - "Luggage Side Trim")
2. Disconnect the woofer speaker connector (A).
3. Remove the woofer speaker (B) after loosening mounting screws.



Surround Speaker

1. Remove the rear pillar trim.
   (Refer to Body - "Rear Pillar Trim")
2. Disconnect the speaker connector(A) and then remove the surround speaker (B).



- Installation

Front Door Speaker

1. Install the front speaker.
2. Install the front door trim.

Rear Door Speaker

1. Install the rear speaker.
2. Install the rear door trim.

Front Center Speaker

1. Install the front center speaker.
2. Install the front center speaker grill.

Front Tweeter Speaker

1. Connect the connector.
2. Install the tweeter speaker and front door quadrant cover.

Rear Tweeter Speaker

1. Connect the connector.
2. Install the tweeter speaker and rear door quadrant cover.

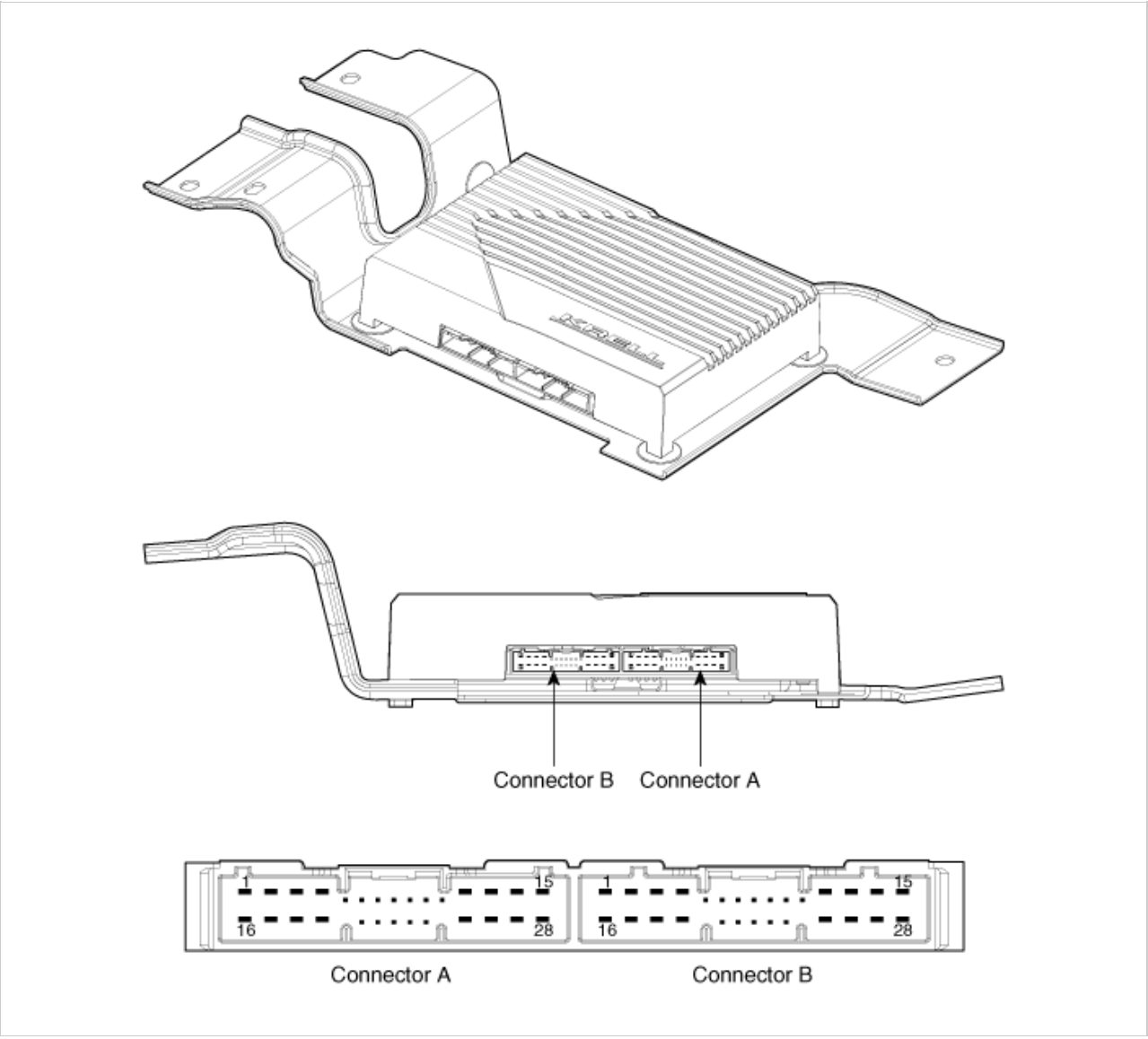
Woofer Speaker

1. Install the woofer speaker.
2. Install the left luggage side trim.

Surround Speaker

1. Install the surround speaker.
2. Install the rear pillar trim.

- Components



Connector Pin Information

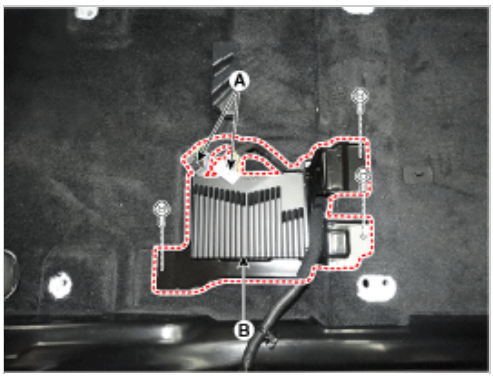
No	Connector A	Connector B
1	Battery (+)	Rear left door speaker (+)

2	Battery (+)	Rear left door speaker (-)
3	Battery (+)	Rear right door speaker (+)
4	Battery (+)	Rear right door speaker (-)
5	-	-
6	M-CAN (High)	-
7	M-CAN (Low)	-
8	ACC	-
9	Navigation voice (+)	-
10	-	-
11	-	-
12	Front left door speaker (+)	-
13	Front left door speaker (-)	Surround left speaker (+)
14	Front right door speaker (+)	Surround left speaker (-)
15	Front right door speaker (-)	Surround right speaker (+)
16	Ground	Surround right speaker (-)
17	Ground	Sub woofer speaker1 (+)
18	Ground	Sub woofer speaker1 (-)
19	Ground	Sub woofer speaker2 (+)
20	SPDIF (+)	Sub woofer speaker2 (-)
21	SPDIF (-)	-
22	SPDIF ground	-
23	Navigation voice (-)	-
24	IGN 1	
25	Front left tweeter speaker (+)	-
26	Front left tweeter speaker (-)	-
27	Front right tweeter speaker (+)	Center speaker (+)
28	Front right tweeter speaker (-)	Center speake (-)

- Removal

External Amplifier

1. Disconnect the negative (-) battery terminal.
2. Remove the passenger seat assembly.
   (Refer to Body - "Front Seat Assembly")
3. Remove the external amplifier (B) after disconnecting the connectors (A) and loosening the mounting bolts (3EA).



- Installation

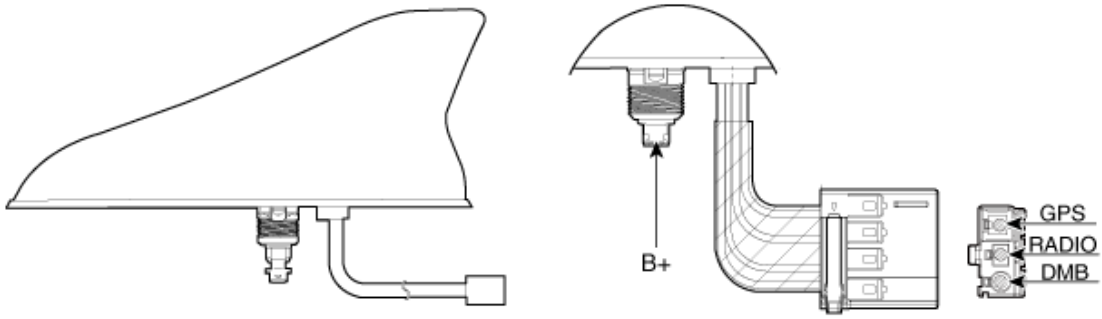
External Amplifier

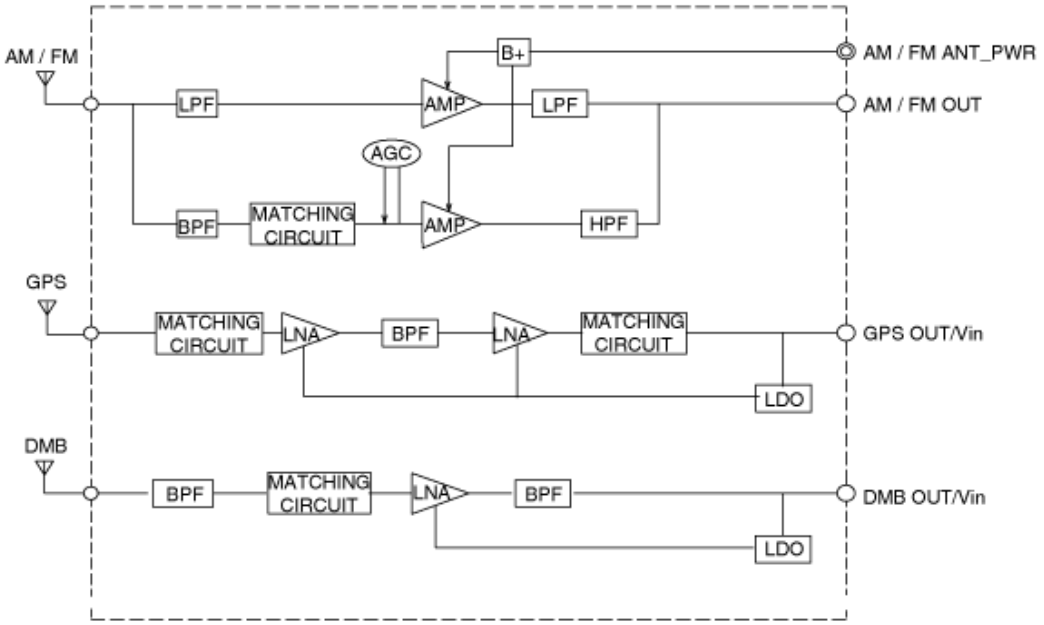
1. Install the external amplifier after connecting the connector.
2. Install the passenger seat assembly.

NOTICE

– Make sure the speaker and related connectors are plugged in properly.

- Components

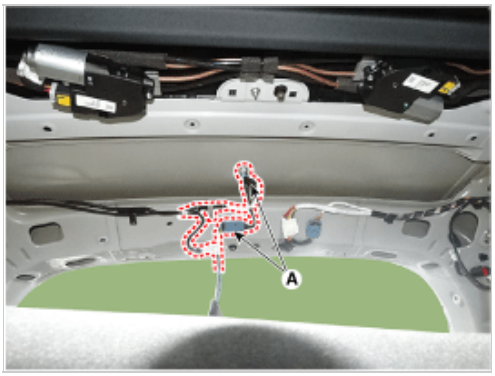




※ LNA : Low Noise Amplifier
BPF : Band Pass Filter
RFC : Radio Frequency Choke

- Removal

1. Disconnect the negative (-) battery terminal.
2. Remove the rear roof trim.
   (Refer to Body - "Roof Trim Assembly")
3. Disconnect the roof antenna connectors (A) from the roof antenna.



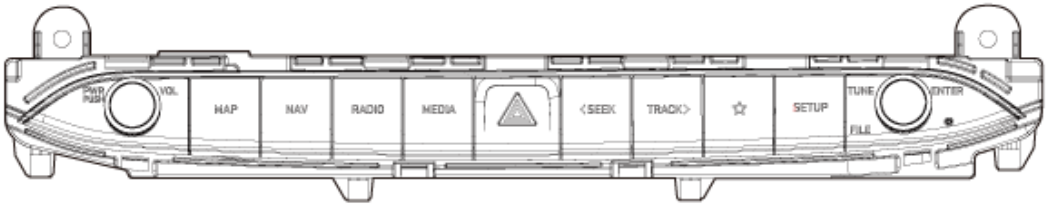
4. Remove the roof antenna (A) after removing a nut.

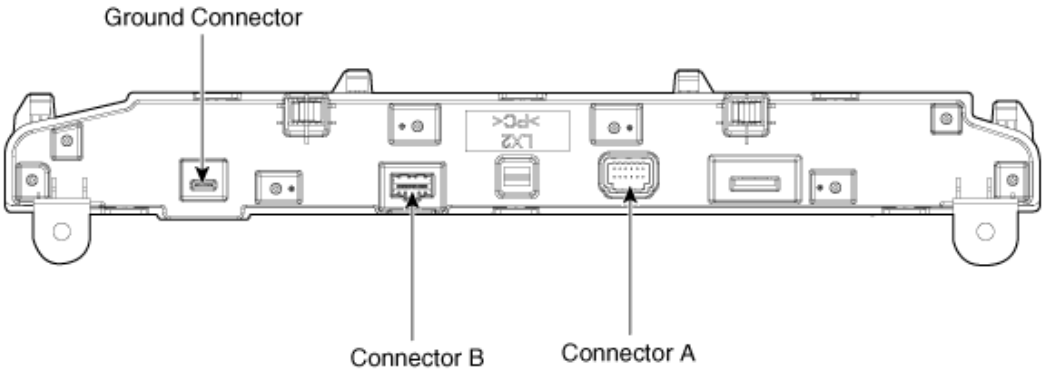
- Installation

1. Connect the roof antenna connectors and then install the roof antenna.
2. Install the rear roof trim.

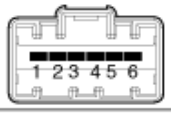
> **NOTICE**
>
> – Make sure that the cables and connectors are plugged in properly.
>
> – Check the audio system.

- Components



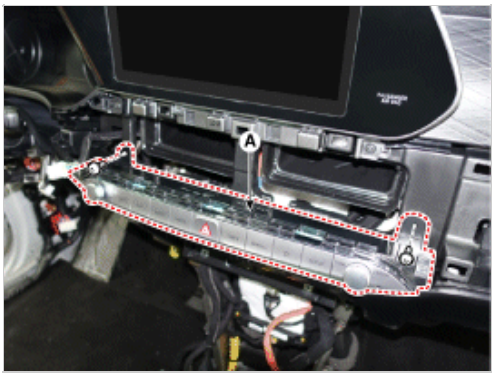


Connector A	Pin	Description	Pin	Description
	1	-	7	MM_CAN (LOW)
	2	Battery (+)	8	MM_CAN (HIGH)
	3	ACC	9	-
	4	-	10	GND
	5	Illumination (-)	11	-
	6	Illumination (+)	12	-

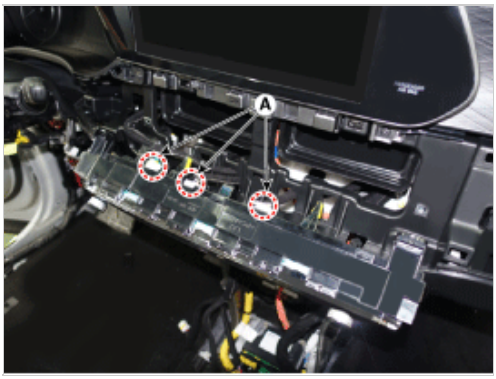
Connector B	Pin	Description	Pin	Description
	1	Battery (+)	4	Hazard Switch
	2	Hazard Indicator	5	-
	3	Ground	6	-

- Removal

1. Disconnct the negative (-) battery terminal.
2. Remove the carsh pad garnish.
   (Refer to Body - "Crash Pad Garnish")
3. Remove the AVN keyboard unit (A) after loosening mounting screws.



4. Dsiconnect the connector (A) and then remove the AVN keyboard unit.



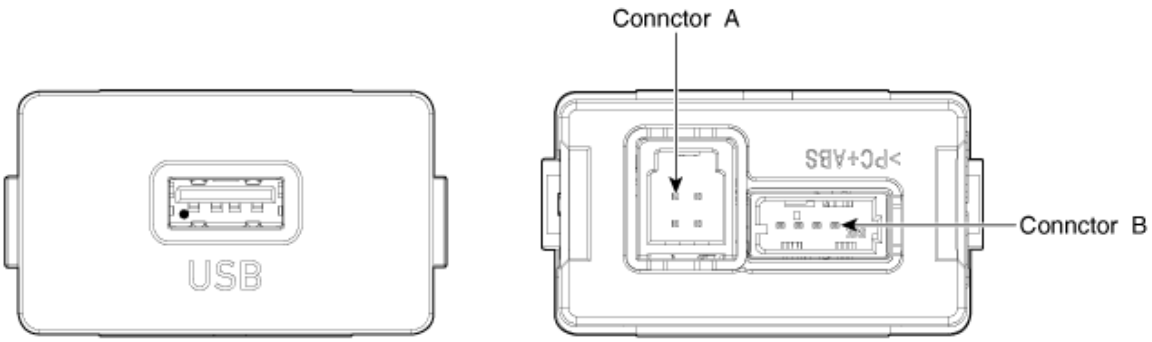
- Installation

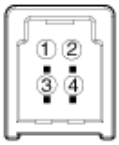
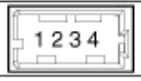
1. Install the audio keyboard unit.
2. Install the carsh pad garnish.
3. Connect the negative (-) battery terminal.

NOTICE

- Make sure the connector are connected in properly.
- Check the audio system.

- Circuit Diagram

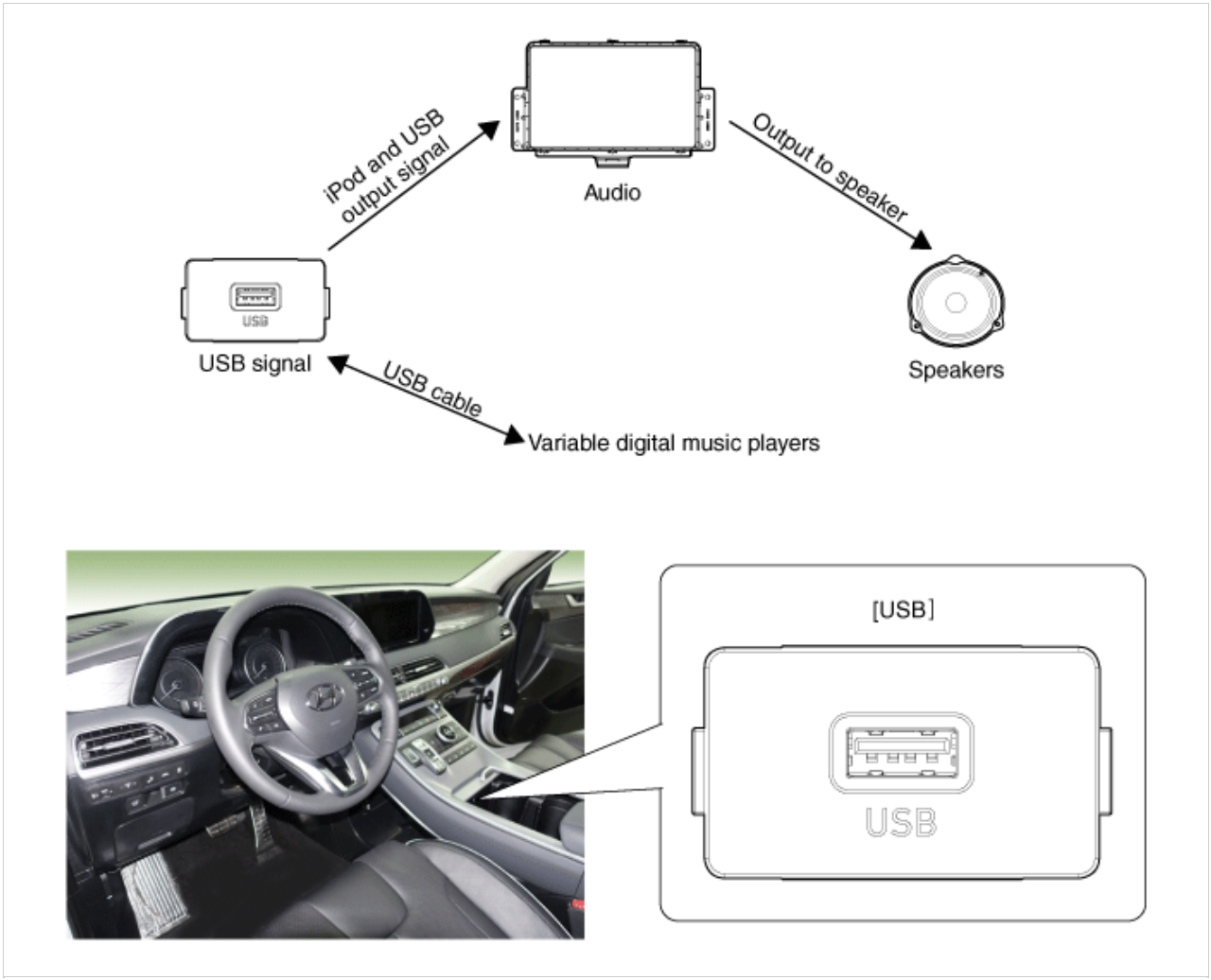


Connctor A	Pin	Description		
	1	Illumination (-)		
	2	DTC		
	3	Illumination (+)		
	4	Ground		
Connctor B	Pin	Description	Pin	Description
	1	USB_Power	3	USB_DATA (High)
	2	USB_DATA (Low)	4	USB_Ground

- Description

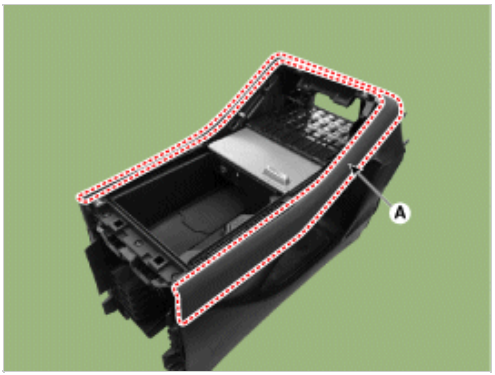
The AUX, iPod and USB JACK on the center console is for customers who like to listen to external portable music players like the MP3, iPod, earphone, USB memory stick, CD player and etc., through the vehicle's sound system when it is linked to this jack.

If sound distortion occurs it may be due to a mismatch of specifications between units.



- Removal

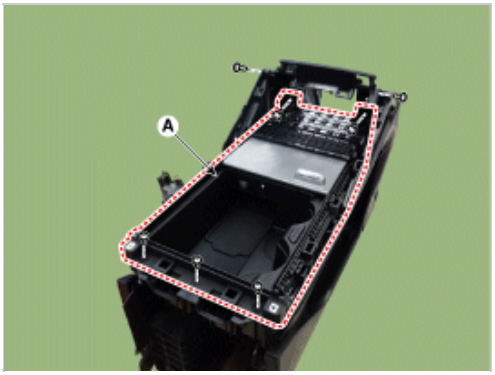
1. Disconnect the negative (-) battery terminal.
2. Remove the front console assembly.
   (Refer to Body - Floor Console Assembly")
3. Remove the front console garnish (A).



⚠ CAUTION

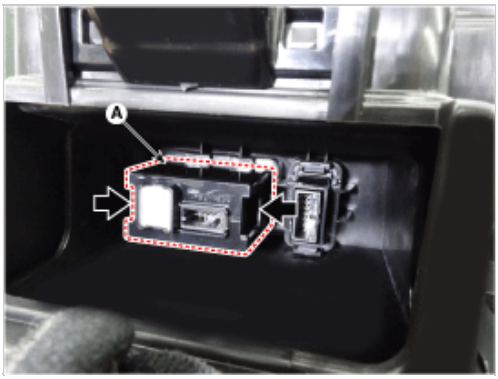
- When removing with a flat-tip screwdriver or remover, wrap protective tape around the tools to prevent damage to components.

4. Remove the front console tray assembly (A).



5. Disconnect the connector (A).

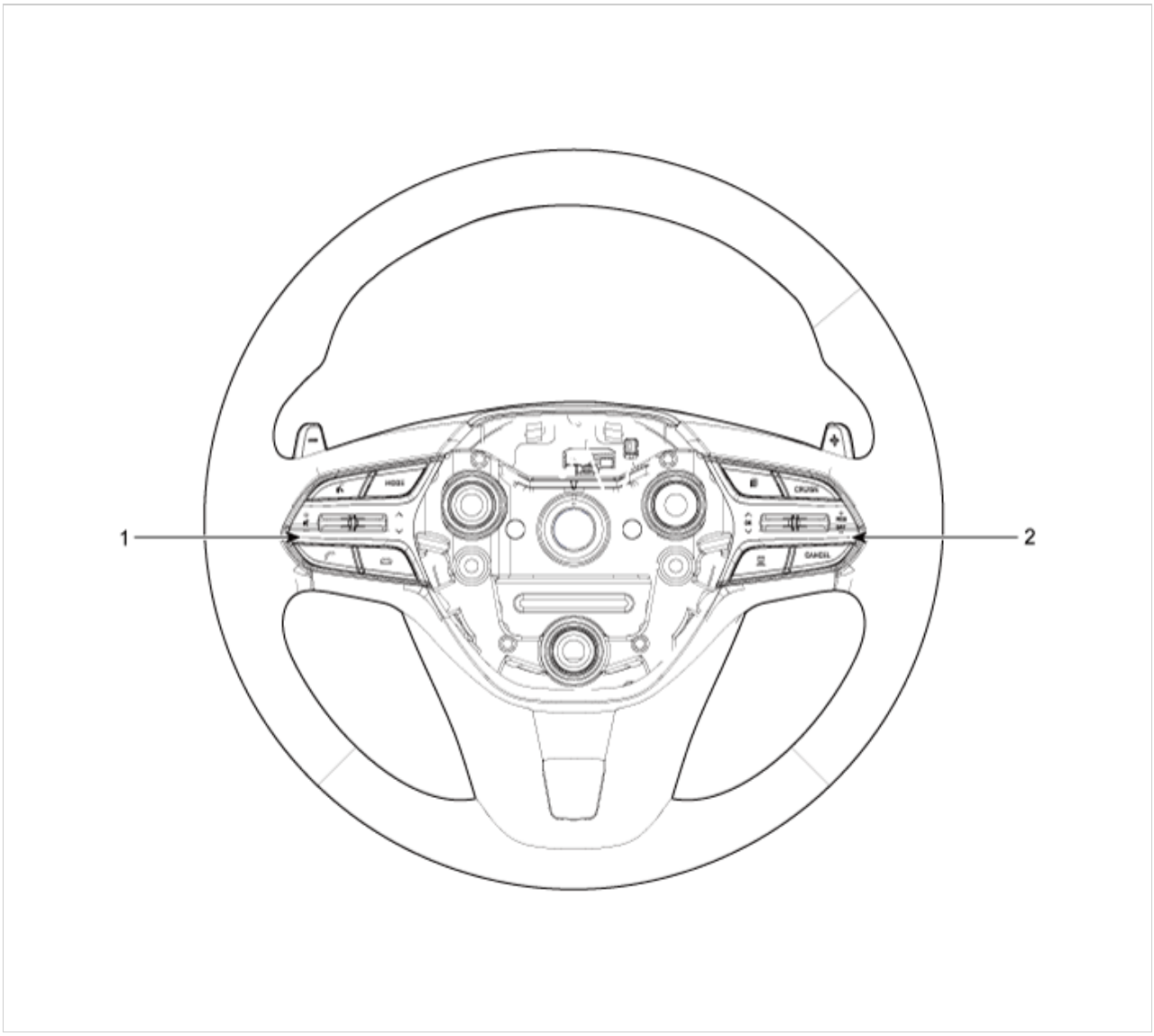
6. Remove the USB (A) by pushing the fixed clip in the direction of the arrow as lillustration below.



- Installation

1. Install the USB.
2. Install the front console assembly.
3. Connect the negative (-) battery connector.

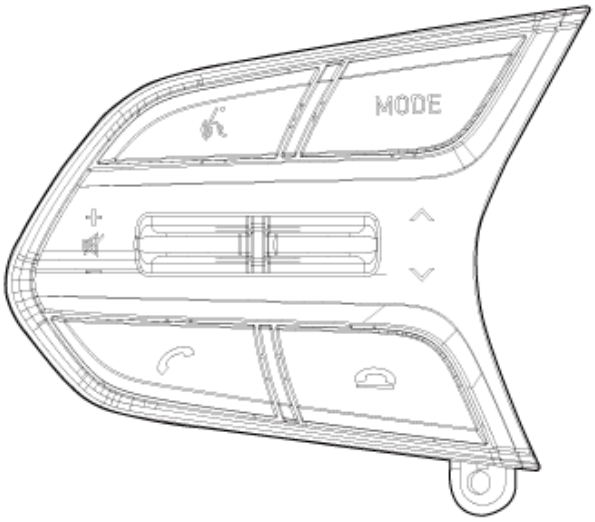
- Components

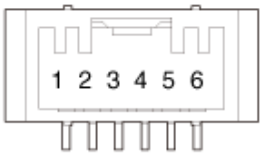


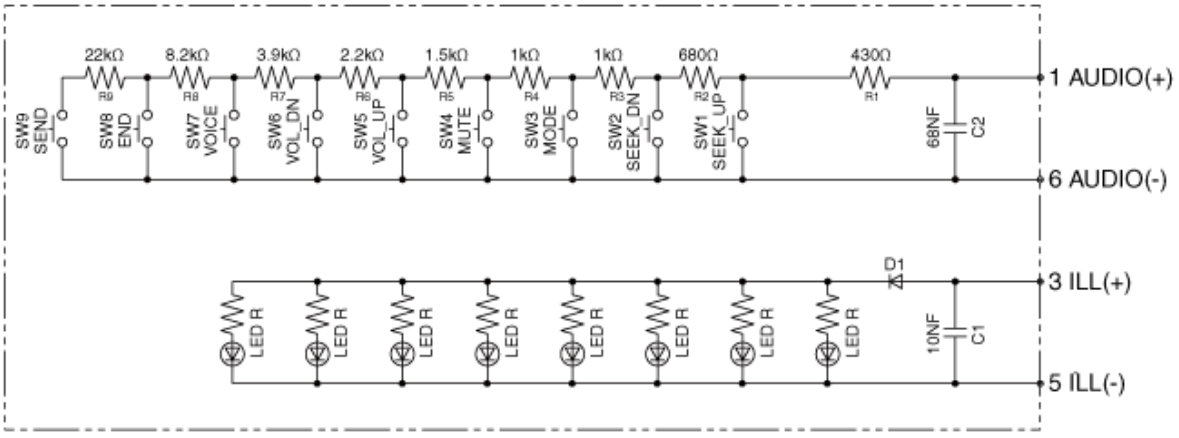
1. Remote control switch (LH : Audio + Voice)
2. Remote control switch (RH : Trip + Cruise)

- Circuit Diagram

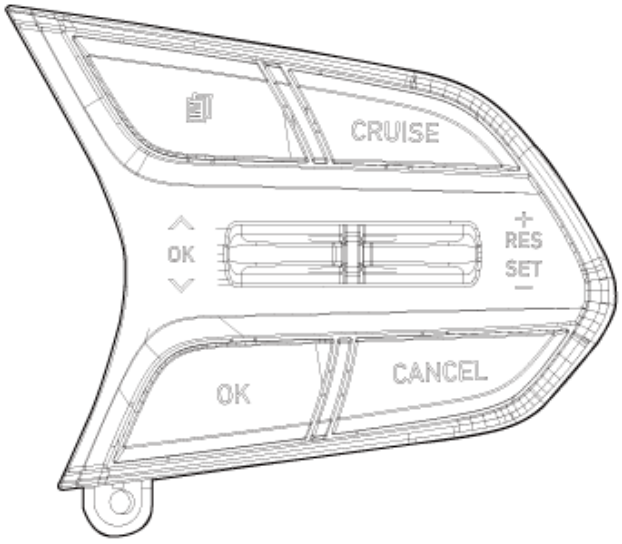
[Audio / Bluetooth / Voice]



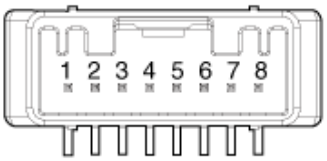
Connector	
	
No.	Description
1	Audio switch (+)
2	-
3	Illumination (+)
4	-
5	Illumination (-)
6	Audio switch (-)



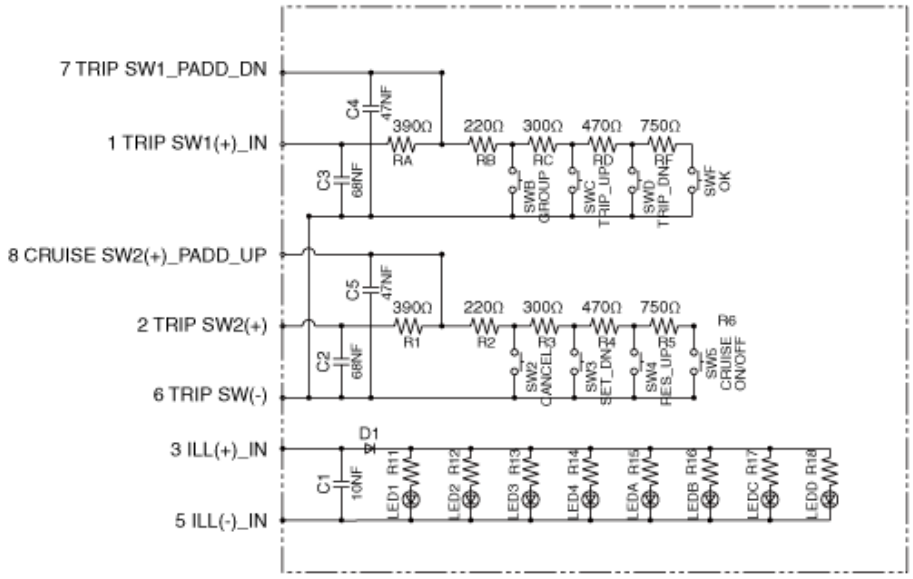
[Trip + Cruise]



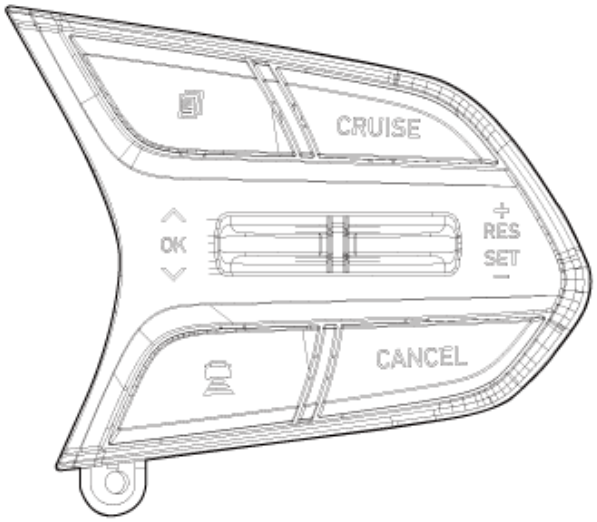
Connector

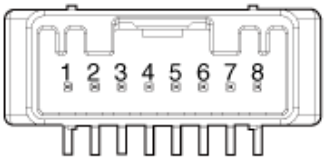


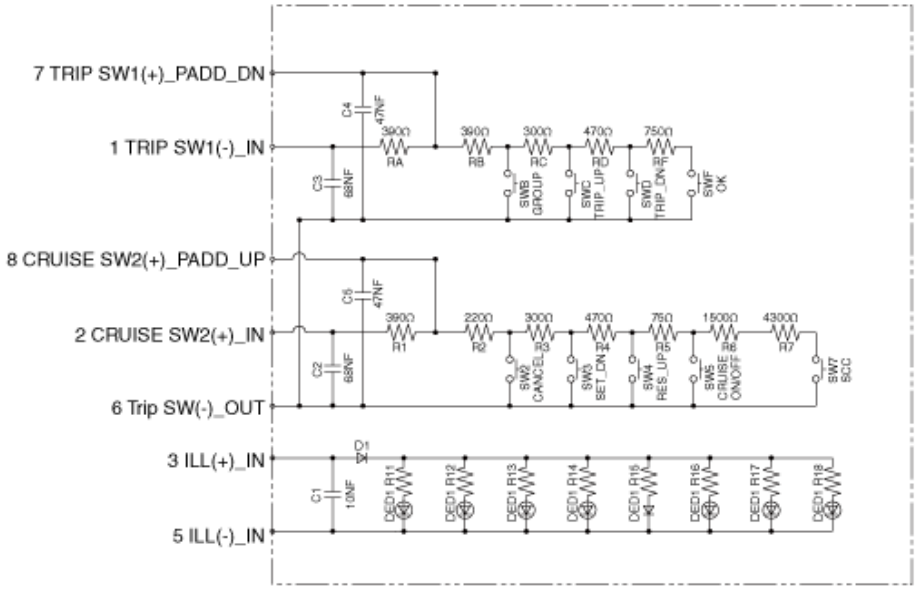
Pin	Description
1	Trip switch1 (+)
2	Trip switch2 (+)
3	Illumination (+)
4	-
5	Illumination (-)
6	Trip switch (-)
7	Trip switch paddle (Down)
8	Trip switch paddle (Up)



[Trip + Cruise + Smart cruise]

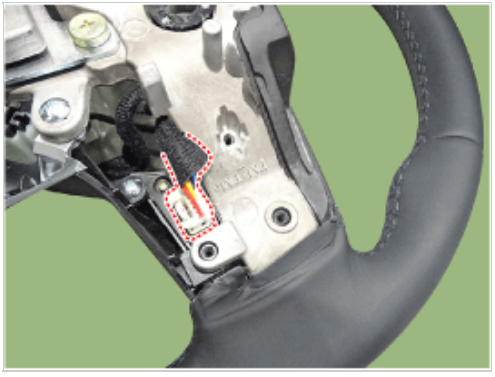


Connector	
	
Pin	Description
1	Trip switch1 (+)
2	Trip switch2 (+)
3	Illumination (+)
4	-
5	Illumination (-)
6	Trip switch (-)
7	Trip switch paddle (Down)
8	Trip switch paddle (Up)



- Inspection

1. Check for resistance between terminals in left switch position.



[Audio / Bluetooth]

Switch	Connector terminal	Resistance (± 3%)
SEEK Up	1 - 6	430 Ω
SEEK Down	1 - 6	1.1 kΩ
MODE	1 - 6	2.11 kΩ
MUTE	1 - 6	3.11 kΩ
Volume up	1 - 6	4.61 kΩ
Volume down	1 - 6	6.81 kΩ
Voice	1 - 6	10.71 kΩ
END	1 - 6	18.91 kΩ
SEND	1 - 6	40.91 kΩ

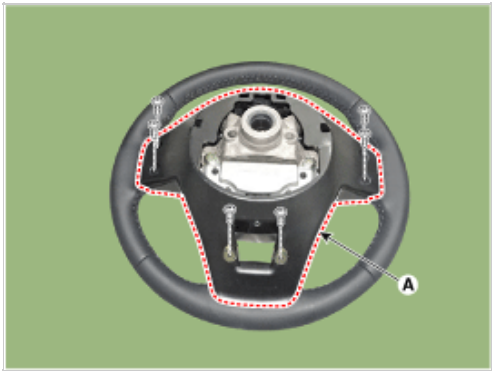
2. Check for resistance between terminals in right switch position.

[Trip / Cruise]

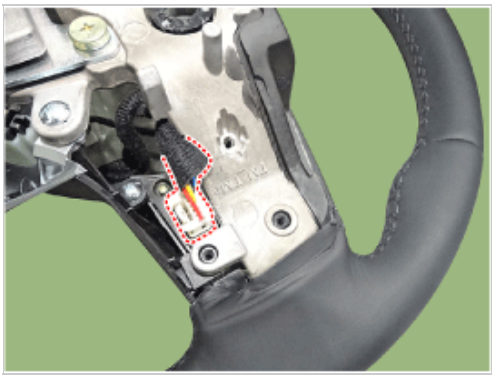
Switch	Connector terminal	Resistance (± 3%)
Paddle UP	2 - 6	390 Ω
CANCEL	2 - 6	610 Ω
SET (-)	2 - 6	910 Ω
RES (+)	2 - 6	1.38 kΩ
Cruise ON/OFF	2 - 6	2.13 kΩ
Cruise Mode	2 - 6	3.63 kΩ
Smart Cruise	2 - 6	7.93 kΩ
Paddle DOWN	1 - 6	390 Ω
Trip Group	1 - 6	610 Ω
Trip Up	1 - 6	910 kΩ
Trip Down	1 - 6	1.38 kΩ
Trip OK	1 - 6	2.13 kΩ

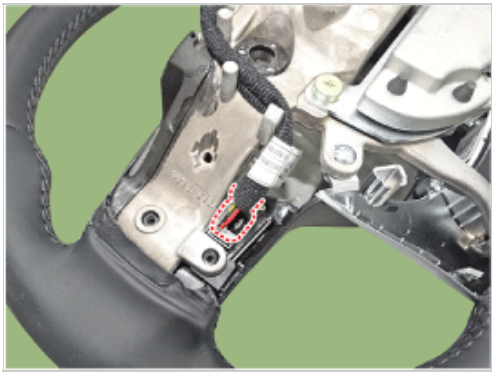
- Removal

1. Disconnect the negative (-) battery terminal.
2. Remove the driver airbag module.
   (Refer to Restraint - "Driver Airbag (DAB) Module and Clock Spring")
3. Remove the steering wheel.
   (Refer to Steering System - "Steering Column and Shaft")
4. Remove the steering wheel cover (A) after loosening the screws.

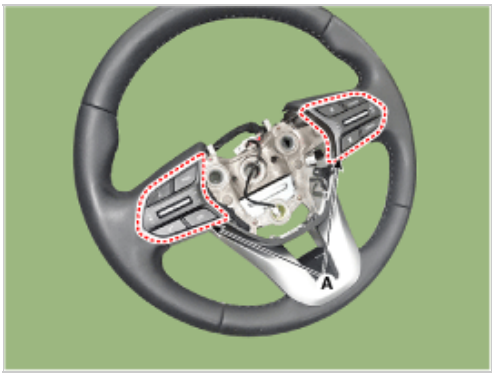


5. Loosen the screws and then disconnect the steering wheel remote control switch connector.





6. Remove the remote control switchs (A).



- Installation

1. Install the remote control switch on the steering wheel.
2. Install the steering wheel.
3. Reconnect the remote control switch connector and airbag connectors.

> **NOTICE**
> Make sure that the switch connector is plugged in properly.

4. Install the driver airbag module.
5. Connect the negative (-) battery terminal.

- Specifications

Smart Key Unit

Items	Specification
Rated voltage	DC 12V
Operating voltage	DC 9 - 16V
Operating temperature	-22°F to 167°F (-30°C to- 75°C)

Load	Max. 4.0mA (When welcome light function off)

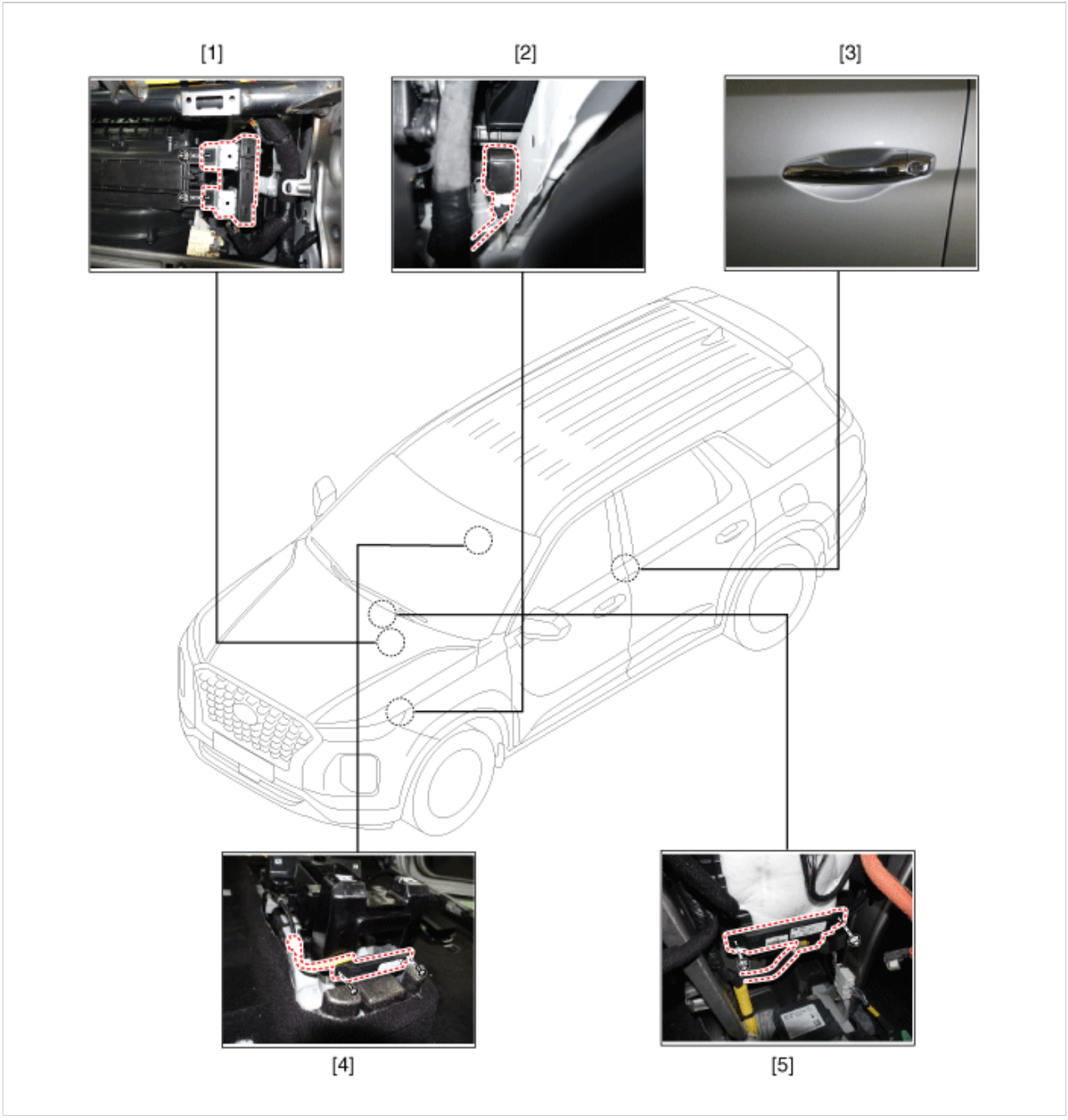
Smart Key Fob

Items	Specification
Battery	Lithium battery 3V 1EA
Distance	30m from vehicle, RF : 30m, Passive(LF) : 0.7m
Battery life	More than 2 years (10 times / a day) **WARNING** An inappropriately disposed battery can be harmful to the environment and human health. Dispose the battery according to your local law(s) or regulation.
Push buttons	5 (Door lock / unlock, Tailgate, Panic/ Button remote start)
Frequency(Rx)	125 kHz
Frequency(Tx)	433.92 MHz
Numbers	2EA

Antenna

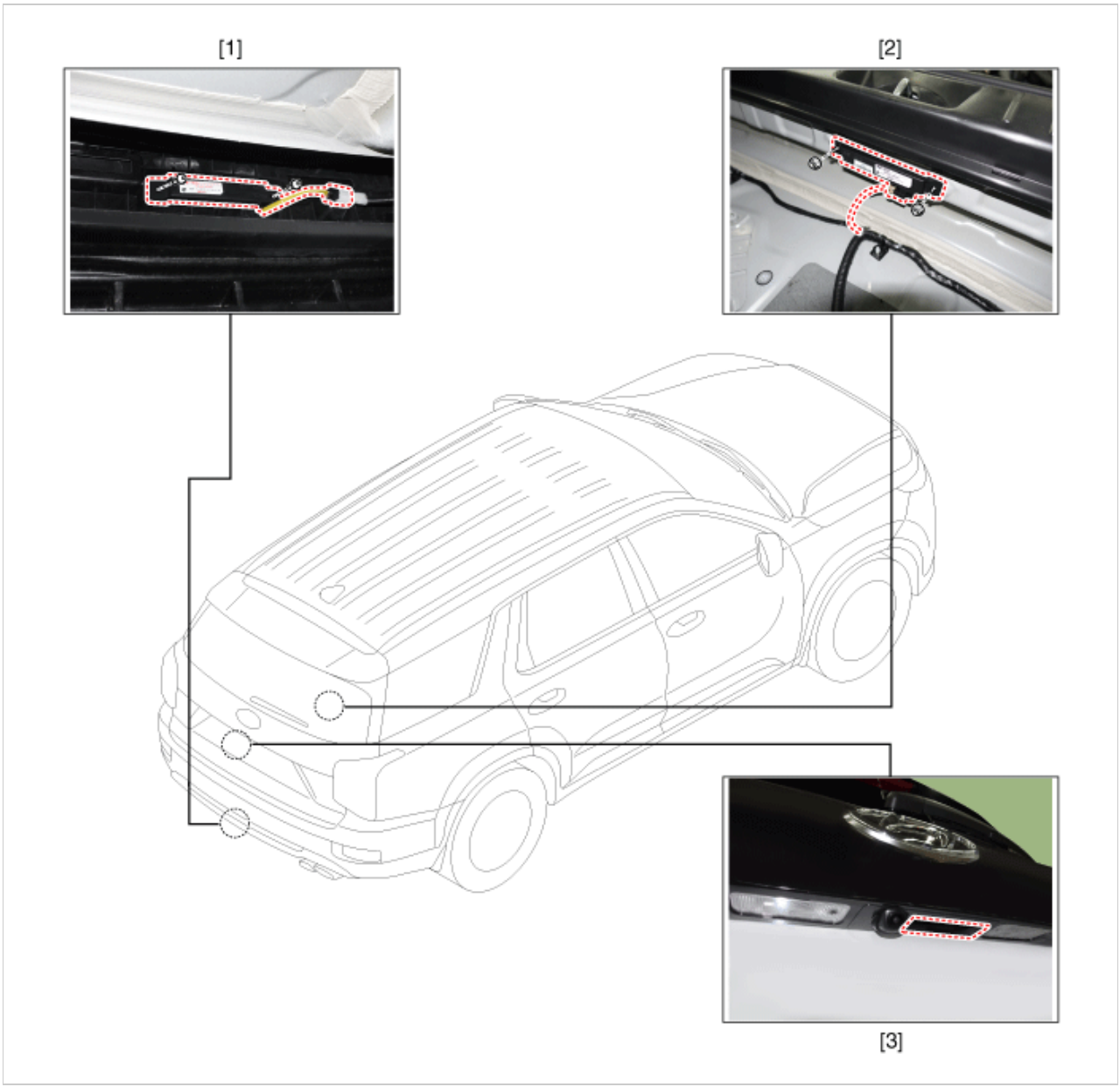
Items	Specification
Rated voltage	DC 12V
Operating voltage	DC 9 - 16V
Operating temperature	-22°F to 185°F (-40°C - 85°C)
Frequency	125kHz
Numbers	Interior (3EA), Door (2EA), Bumper -(1EA)

- Component Location (1)



1. Integrated Body Control Unit (IBU)
2. Buzzer
3. Door outside handle
4. Interior antenna 2
5. Interior antenna 1

Component Location (2)



1. Bumper antenna
2. Trunk antenna
3. Tailgate open switch

- Description

The SMART KEY system is a system that allows the user to access and operate a vehicle in a very convenient way. To access the vehicle, no traditional key or remote control unit is needed.

The user carries a SMART KEY FOB which does not require any conscious actions by the user (e.g. operate a RKE button). The SMART KEY system is triggered by pressing a push button in the door handle.

After being triggered the vehicle sends out a request in a limited range. If the SMART KEY FOB receives this request, it automatically sends a response to the vehicle. Then the system decides whether to perform a particular action (unlocking, locking…) or remain inactive.

In a similar manner the vehicle's Electrical Steering Column Lock (ESCL) is released. Again, a communication between the vehicle and the SMART KEY FOB is needed before any actions will be performed.

The System offers the following features :

- Passive unlock via door driver side and passenger side
- Passive locking via door driver side and passenger side
- Passive start
- Passive access trunk via the trunk lid switch at the trunk
-

Passive locking via tailgate

- Max. 2 fobs can be handled by the system
- Immobilizer backup antenna driver integrated into SSB for TP authentication (i.e. limp home mode)
- Communication with engine management system
- Communication with SRX
- LF-RF communication

1. Passive unlock

   The system allows the user to access (unlock) the vehicle without performing any actions with the SMART KEY FOB. This feature could be different depending on platform as follows:

   - Pressing Push button in door handle

2. Passive locking

   The system allows the user to lock the vehicle by pushing a button on door handle with the SMART KEY FOB.

3. Button start

   The system allows the user to release ESCL and to switch the power modes (Off, Accessory, Ignition), as well as to start and stop the vehicle's engine without performing any actions with the SMART KEY FOB. See Button Engine Start system specification.

4. LIMP HOME Mode

   Additionally, the system offers so called "limp home mode", which is the user can operate all vehicle functions by pushing the key into the SSB.

Smart Key ECU (SMK ECU)

The SMK ECU manages all functions related to "Passive Unlock", "Passive Lock" and "Passive Authorization for Engine Start Operation".

It reads the inputs (Push button in door handle, Start Stop Button (SSB), PARK position Switch), controls the outputs (e.g. exterior and interior antennas), and communicates via the CAN as well as a single line interface to further devices of the car.

For communication with the SMART KEY FOB, SMK ECU generates a request (challenge) as an encoded and modulated 125 (or 134.2) kHz signal at the inductive antenna outputs and receives the SMART KEY FOB's response via the external RF receiver.

The main functional blocks of the SMK ECU are:

- Power supply
- Microcontroller with FLASH Memory
- Single Line Interface to SRX
- Single Line Interface to EMS
- Input stage
- LF antenna amplifier/driver
- CAN communication with BCM

The LF antenna amplifier/driver generates a 125 (or 134.2) kHz sinusoidal carrier signal which is distributed to the different antennas.

Smart Key FOB

The system supports up to 2 SMART KEY FOBs.

The main functions of the SMART KEY FOB are :

- Passive functionality : receives LF-challenge and sends automatically RF response.
- Classic RKE function by action up to 4 push buttons.
- Transponder-functionality in case of a flat battery or a disturbed communication.

Antennas

1. Emitting LF Antennas:

   Inductive antennas in and at the vehicle are used to transform the current, driven by the SMK ECU antenna driver, into a 125 (or 134.2) kHz magnetic field, which is the carrier for the SMART KEY challenge.

   Three antennas cover the vehicle's exterio : two antennas in the Door Handles (DS and PS) cover the area around the doors; one antenna in the rear bumper covers the area around the trunk or tailgate.

   Up to three antennas cover the vehicle's interior and the trunk or tailgate interior: two in the passenger compartment and one in the tailgate room or trunk.

2. Bidirectional Immobilizer Antenna (for Limp Home) :

   The Immobilizer Backup Antenna is used for sending and receiving data: it emits a magnetic field (125 - 135 kHz challenge) and receives changes in the field strength (response of Transponder).

3. External Receiver

   The SMART KEY FOB's response is received via the external RF receiver, which is connected to the SMK ECU via a serial communication Line.

   The SMK ECU provides a connector pin for the serial communication Line.

Door Handle

The front door handles of the two doors (driver door / passenger door) are equipped with emitting LF-antennas to emit the 125 (or 134.2) kHz signals. The front door handles are also equipped with a push button.

Push Button

The push button in door handle serves as a trigger to indicate the user's intent to unlock or lock the vehicle.

The push buttons are installed at front doors, integrated into the door handles.

Another button is installed at the trunk or tailgate lid.

- Operation

Passive Functions

The system allows the user to access the vehicle without having to perform any actions (e.g. RKE button pressing) with the SMART KEY FOB. It is sufficient that a valid SMART KEY FOB is located within a defined and limited range with respect to the vehicle. So the system is capable of detecting and authenticating a SMART KEY FOB in the ranges as specified below.

Operating Range

The SMART KEY FOB receives and interprets a challenge sent from the vehicle via the exterior antennas in a free space range of min. 0.7m measured around the exterior antennas which are integrated in the door handles; refer to the below given picture. The trunk or tailgate access range is also min. 0.7m measured from the antenna position.

The SMART KEY FOB receives and interprets a challenge sent from the vehicle via the exterior antennas in a free space range of min. 0.7m measured around the exterior antennas which are integrated in the door handles; refer to the below given picture

Passive Access (Passive Entry)

Pressing one of the push buttons in the door handles when all doors locked indicates the operator's intent to access the vehicle and thus triggers the system for unlock

Passive Locking (Exit)

Pressing one of the push buttons in the door handles when one of the following condition is fulfilled:

- At least one door is unlocked and two_steps timer is not running or
- Two_steps timer is running and one of the push button except Front Left side is triggered

indicates the operator's intent to lock the vehicle and thus triggers the system for a lock.

Passive Open Tailgate

Pressing the Trunk/Tailgate Lid Switch when Trunk/Tailgate is closed indicates the operator's intent to open the Trunk/Tailgate and thus triggers the system. Subsequently, the SMK ECU sends a LF-challenge to the SMART KEY FOB via the exterior bumper antenna. The SMART KEY FOB answers with a RF-response. If the received response matches the expected answer, SMK ECU sends a "Trunk/Tailgate open" message via the CAN network.

Passive Trunk Warning (Sedan only)

Whenever the trunk is closed, SMK ECU uses a suitable search strategy to avoid trunk buzzer warning by a fob outside the vehicle. Then SMK searches for a SMART KEY FOB in the interior of the trunk. If a valid SMART KEY FOB is found in the trunk, the SMK ECU activates SMK external buzzer (TBD) to inform the user that the trunk has been closed with a fob inside the trunk.

SMK will send the trunk open command to BCM for trunk reopening if trunk reopening bit is set(BK)For this functionality, a "valid" SMART KEY FOB means any SMART KEY FOB that belongs to the vehicle, even if it's DEACTIVATED.

NOTICE

– A blind spot in the trunk similar to any RF disturbance may lead to no trunk warning. Due to the penetration of the bumper antenna into the trunk area the lid may open without an Identification Device outside.

– A blind spot in the trunk similar to any RF disturbance may lead to no trunk warning

Smart Liftgate

When a user with a valid Smart Key in possession stands in the vicinity of the rear bumper (within LF antenna range) for over 3 seconds, the trunk is opened.

NOTICE

Function is set through the User Setting Mode (USM) in the Cluster.

1. Rear bumper antenna detects valid Smart Key in the vicinity.

2. When a valid Smart Key enters the rear bumper antenna range, alert buzzer and hazard lamp is activated 1 time to acknowledge detection.

> **NOTICE**
> – Smart Key Unit can detect a Smart Key within 0.7-1 m of the rear bumper.
> – If the Smart Key stays inside the detection range, alert buzzer and hazard lamp is activated 1 time every second throughout the duration of the Smart Key remaining in the detection range.

3. If the Smart Key remains in the rear bumper detection range (antenna range) for over 3 seconds, alert buzzer and hazard lamp is activated 2 times and the trunk is opened.

Smart Key Reminder 1

1. Preconditions :
   All terminals OFF & at least one door open & locking status is not locked checked by SMK periodically every 100ms, as long as CAN/LIN active.
2. Event:
   At least 1 door knob status changed from unlock to lock.
3. SMK actions :
   - IF NO FOB-IN ACTIVE
     SMK performs a search for the fobs in the interior of the vehicle. The same LF-strategy has to be used as it is defined for the ID out warning (registering only, no authentication
   - IF FOB-IN ACTIVE
     SMK search valid TP

   If no fob or no TP has been found, no action is required.
   If any valid fob or valid TP has been found, SMK unlocks the vehicle by sending a CAN Key Reminder unlock message with the fob number.
   If any valid fob has been found, SMK unlocks the vehicle by sending a CAN/LIN Key Reminder unlock message with the fob number.

Smart Key Reminder 2

1. Preconditions :
   All terminals OFF & any door (including trunk) open & no FOB-IN & no locking status (checked by SMK periodically every 100ms, as long as CAN/LIN active)
2. Vehicle action :
   Closing last door or trunk with knobs locked state, or with a locking in progress
3. SMK actions:
   Before elapsing 500ms after the closing if all doors are locked then :
   - IF NO FOB-IN ACTIVE
     SMK performs a search for the fobs in the interior of the vehicle.
     The same LF-strategy has to be used as it is defined for the ID out warning (registering only, no authentication)
   - IF FOB-IN ACTIVE
     SMK search valid TP

   If no fob has been found, no action is required.
   If any valid fob or valid TP has been found, SMK sends unlock command via CAN and activates ext. buzzer warning.
   If any valid fob has been found, SMK sends unlock command via CAN/LIN and activates ext. buzzer warning.

Smart Key Door Lock Warning

Door Lock Warning 1

1. If terminal state is ACC or IGN and all doors are closed and that user triggers a SMK lock, a search is started at the exterior of the vehicle from the side of the trigger.
2. If no valid Fob is found no action is required, but if a valid Fob is found then a Buzzer warning shall be started.
3. If "b_TailgateOption == On" and "b_TailgateLockUnlockOption == On" are fullfilled, Lock warning is including tailgate as a door and tailgate lockunlock knob as a door unlock switch.

Door Lock Warning 2

1. If terminal state is OFF and not all doors are closed and that user triggers a SMK lock, a search is started at the exterior of the vehicle from the side of the trigger.

2. If no valid Fob is found no action is required, but if a valid Fob is found then a Buzzer warning shall be started.
3. If "b_TailgateOption == On" and "b_TailgateLockUnlockOption == On" are fullfilled, Lock warning is including tailgate as a door and tailgate lockunlock knob as a door unlock switch.

Door Lock Warning 3

1. If terminal state is OFF and ATWS is considered as Disarmed and all doors are closed and that user triggers a SMK lock, a search is started at the Interior of the vehicle;
2. if no valid Fob is found the search for SMK locking will be started, but if a valid Fob is found then a Buzzer warning shall be started.
3. If "b_TailgateOption == On" and "b_TailgateLockUnlockOption == On" are fullfilled, Lock warning is including tailgate as a door and tailgate lockunlock knob as a door unlock switch.

Smartkey Lamp Warning

1. If terminal state is ACC or IGN and vehicle speed is less than 3km/h, a periodic search (every 3s) is done at the interior of the vehicle to check that the valid fob is still in the in the vehicle.
2. If no valid Fob is found a Warning is started, but if a valid Fob is found then no action is started.

Failsafe Functions (Backup For Limp Home)

In case of a discharged battery of the SMART KEY FOB or disturbed transmission, the following functions are available:

- Unlocking / locking of doors or trunk (or tailgate depending of the vehicle configuration) : use of mechanical key

User Information Functions

ID OUT Warning

1. Preconditions:
   - (ACC or IGN1) & (any door open or trunk open)
2. Event :
   The last opened door is closed
3. SMK action :
   SMK searches for a SMART KEY FOB in the interior.
   - If no valid SMART KEY FOB is found, the SMK activates external buzzer and also sends ID OUT warning via CAN (exterior buzzer warning and internal buzzer warning).
   - If a door is opened and closed again during terminals on and inside valid fob, SMK re-enables the authentication and stops the warning. If the terminal is in ACC, SMK shall turn on immobilizer lamp.

NOTICE

If there is a LF error (LF overheating or LF antenna failure), the system will have the same behavior as it is with no fob found.

Fob Battery Low Voltage Detection

To detect fob low battery condition, certain battery voltage measurement and low voltage detection strategy are implemented into fob. The measurement of the battery voltage will be done if fob button is pressed or if a LF measurement command is received.

Learning Description

In this chapter, the learning procedure for SMK, ESCL and FOBs is described.

For the learning of the SMK, ESCL and FOBs, it's necessary to have a connection to the diagnostic tool.

Learning MODE

Whatever the mode, the learning procedures are managed by the SMK.

Prior to start learning service, Fob-In signal must be active and the vehicle secret code (called as PIN code) should be known.

Teaching MODE

This mode is used by the dealers in order to replace SMK and/or ESCL and/or the set of keys, or to register additional keys for an existing system. That means the system already has been learnt with certain PIN Code. The PIN Code is fixed for the life time of the vehicle, therefore the same PIN Code must be used in this mode. Otherwise learning will be failed

Teaching MODE Procedure Description (Step By Step)

Objective : Key teaching procedure at service station

Initial state :

– SMK replacement : SMK is not learnt and ESCL and SMART FOB are already learnt with same PIN code

– ESCL replacement : ESCL is not learnt, SMK and SMART FOB are already learnt with same PIN code

– Additional or new keys teaching : SMK and ESCL are already learnt with same PIN code

Smart key teaching

Insert smart key #1 to key holder

↓

SMK start to learn

↓

Input the PIN code

↓

ESCL start to learn

↓

Smart key #1 learnt

↓

SMK/ESCL learnt

↓

Pull out smart key #1

↓

Insert smart key #2 to holder

↓

Smart key #2 learnt

- Smart key system is learned **transponder and smart key** by once at same time.

<Smart key neutralization mode>

- Neutralization mode is for replacing Smart key unit, ESCL ECM easily.
- It is possible that smart key is learnt again, after neutralizing Smart key system.
- Virgin start (twice ignition) is impossible in neutralized condition

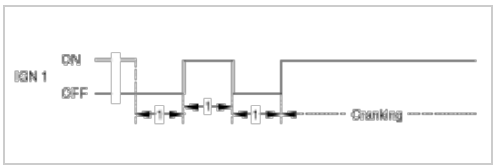
<Lock by timer>

- If PIN code is inputted over 3 times, it is the system is locked and cannot be learned until one hour has passed.

Starting After Replacing (Virgin Start)

Starting is possible by following process after replacing new smart key unit, FOB key or ESCL.

- It is for starting at virgin condition
- All related parts are virgin condition (Smart key, ESCL ECM)
- ESCL is always unlock at virgin
- Press brake pedal in P or N range
- Push the start button once with virgin smart key.

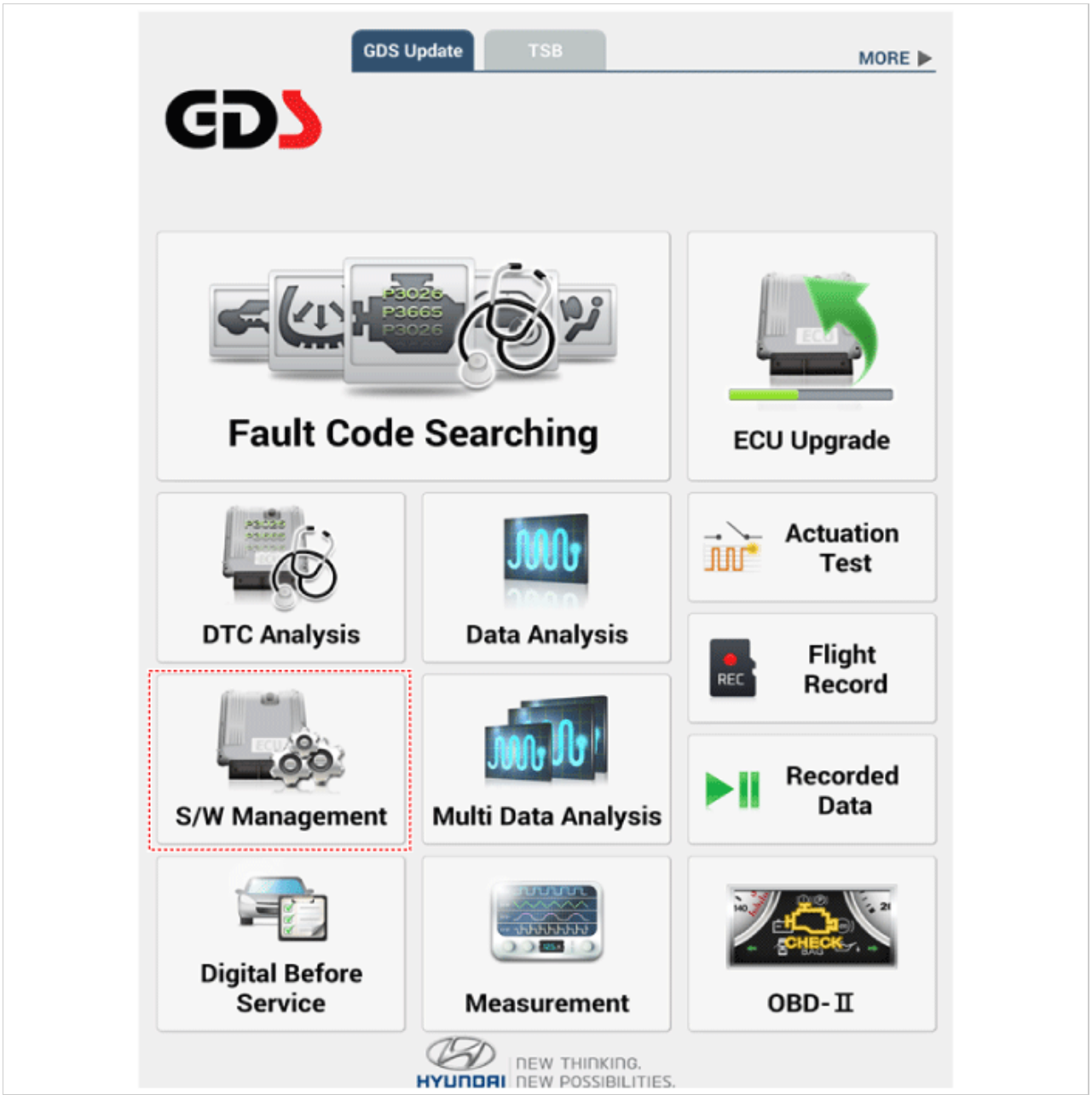


- Smart Key

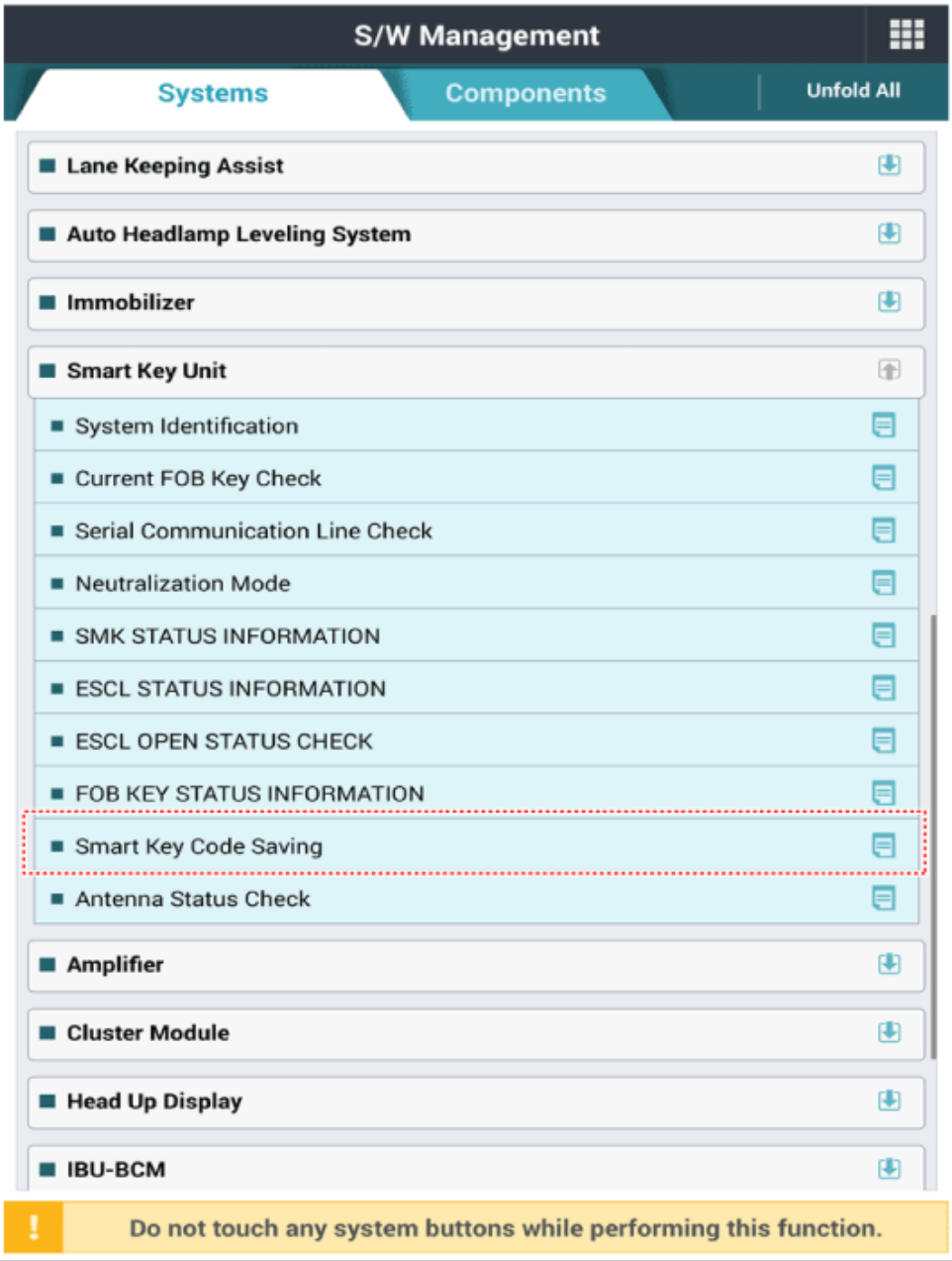
Smart Key Code Saving

1. Connect the DLC cable of Diagnostic tool to the data link connector (16 pins) in driver side crash pad lower panel, turn the power on Diagnostic tool.

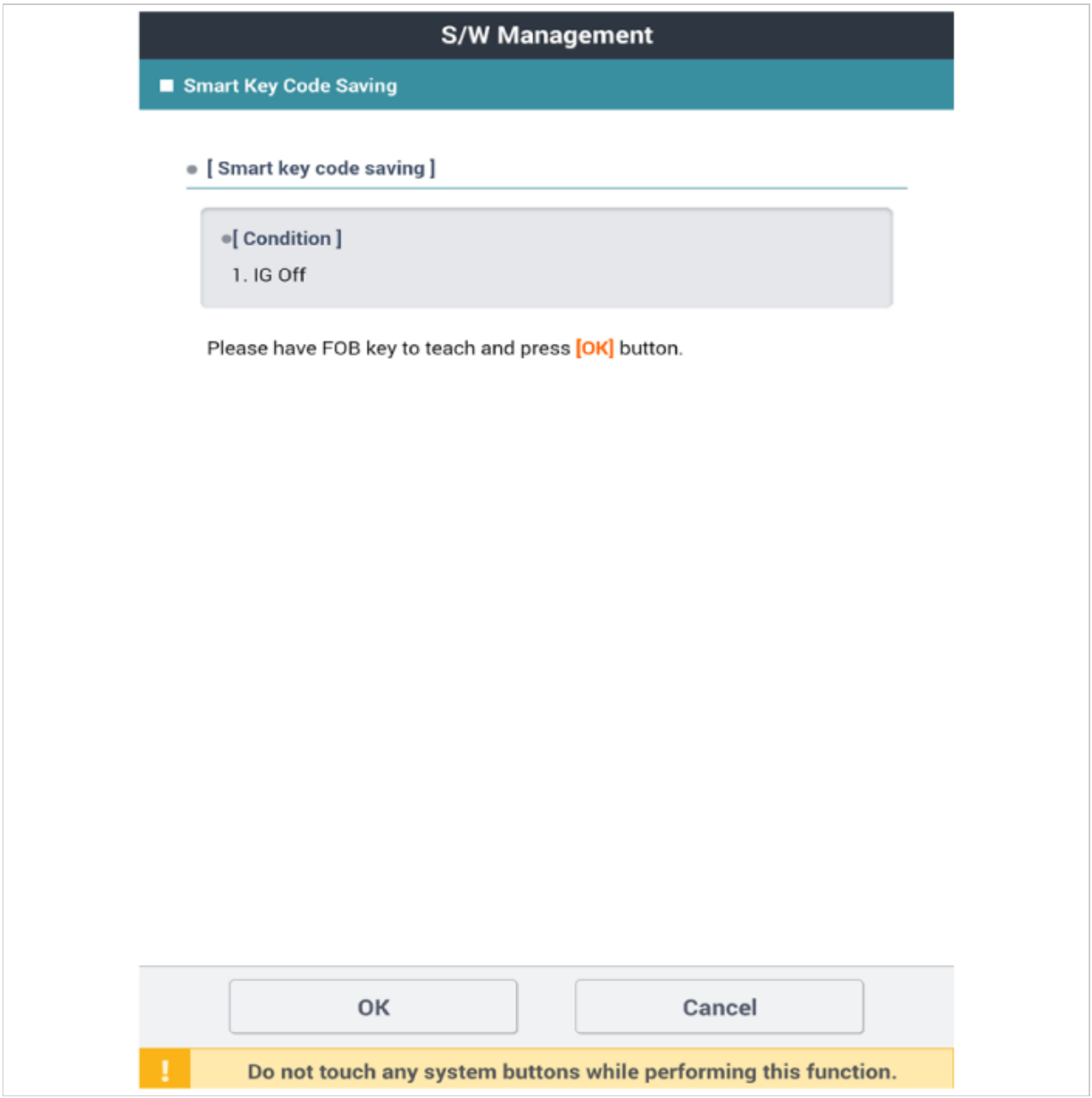
2. Select the 'S/W Management' and 'Car model'.



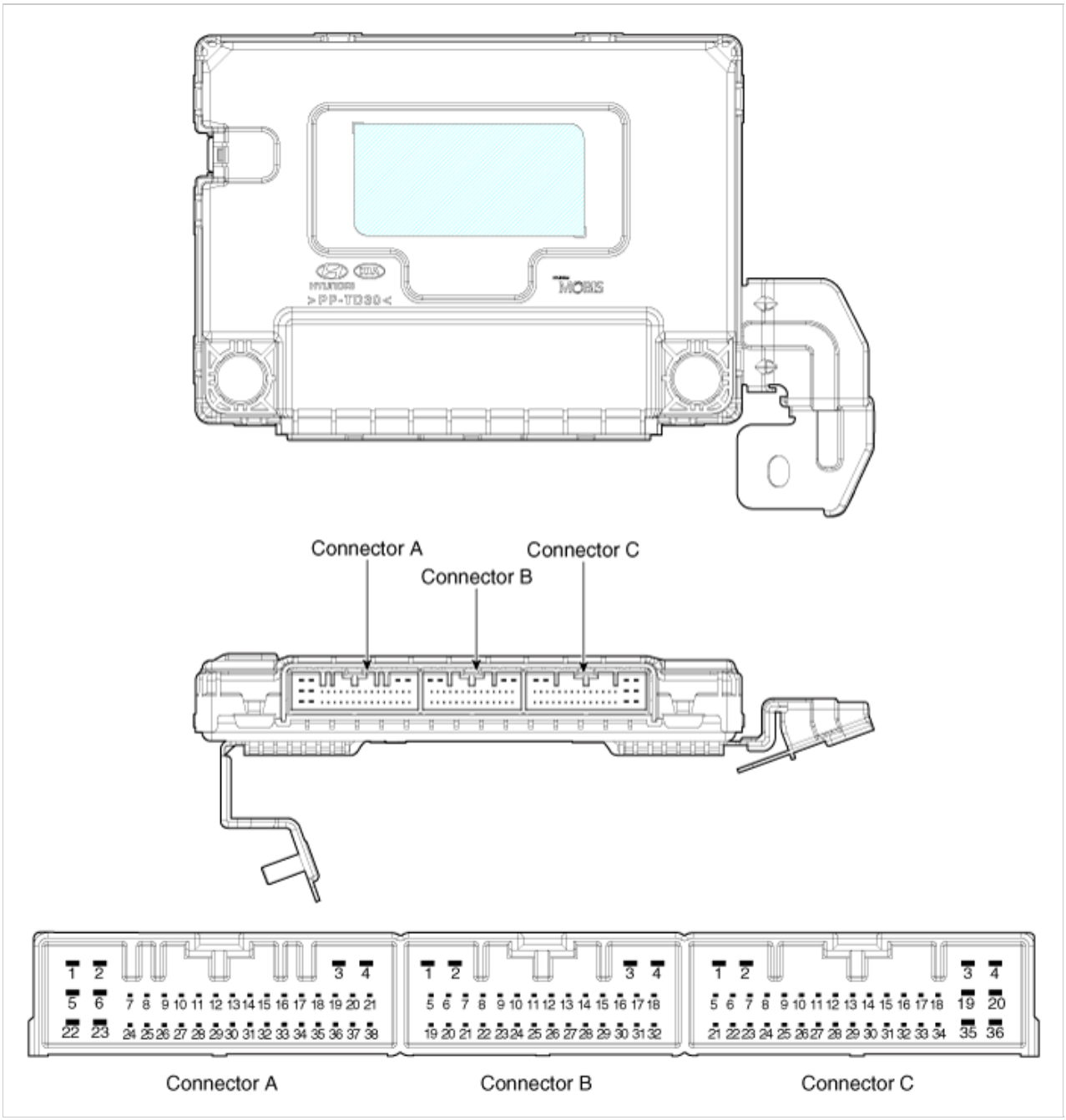
3. Select the 'Smart Key Unit' and 'Smart Key Code Saving'.



4. Follow the instructions on the screen.


S/W Management
Smart Key Code Saving
[Smart key code saving]
[Condition]
1. IG Off
Please have FOB key to teach and press [OK] button.
OK
Cancel
Do not touch any system buttons while performing this function.

- Components (1)

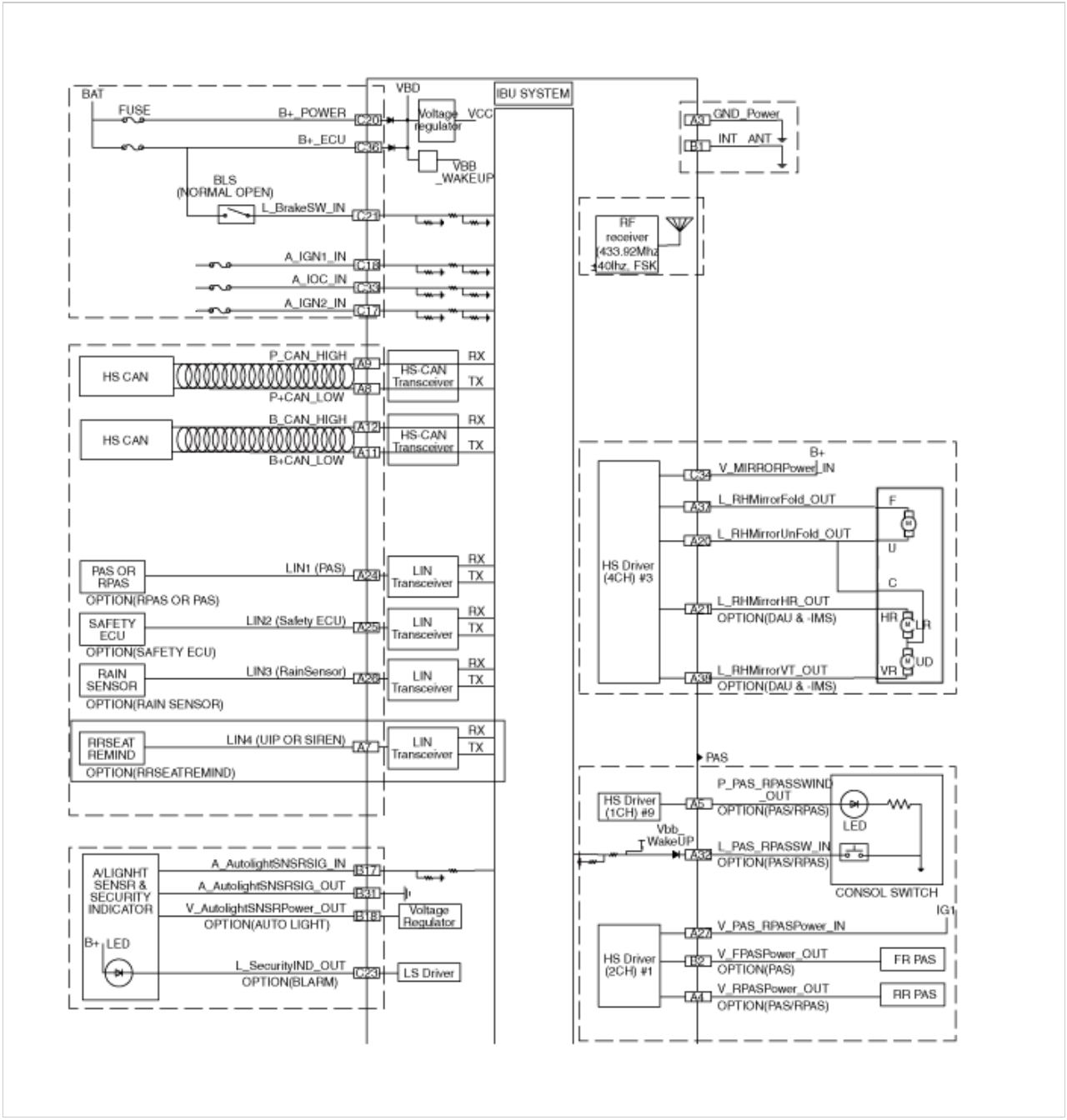


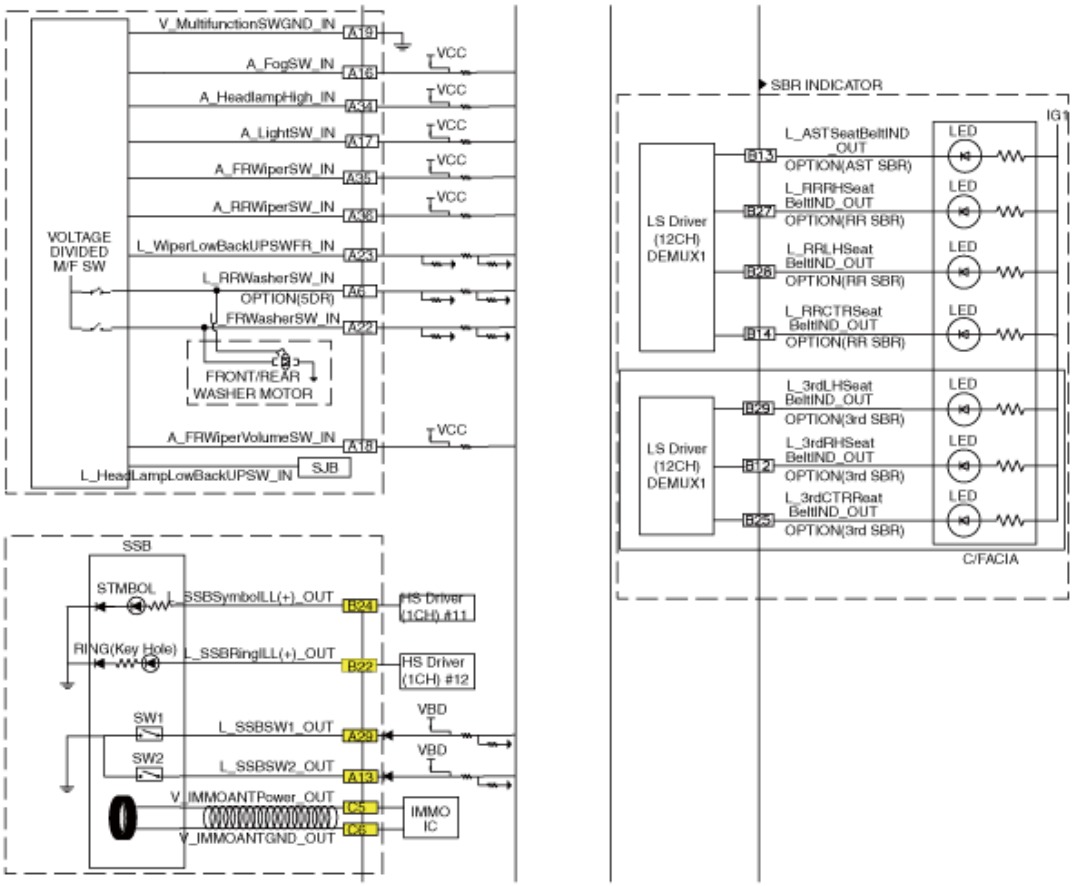
Connector Pin Information

No	Connector A	Connector B	Connector C
1	-	GND_ECU	Front wiper relay (Low)_output
2	-	PDW-F power_output	ESCL (+)_output
3	GND_Power	ESCL (-)_output	Start relay_output
4	PDW-R_Power_Output	Front wiper high relay_output	IGN1 relay_output
5	-	PDW-R WIND_output	Immobilizer antenna power_output
6	Rear washer switch_input	-	Immobilizer antenna ground_output
7	LIN4 (Rear seat remind)	-	-
8	P_CAN (Low)	Rear view switch_input	Interior1 antenna (+)_output
9	P_CAN (High)	-	Driver outside handle antenna(+)_output
10	-	Wheel speed sensor_input	-
11	B_CAN (Low)	-	Passenger outside handle antenna(+)_output
12	B_CAN (High)	3rd line sheet belt indicator RH_output	-

13	SSB switch_input	Passenger seat belt indicator_output	Trunk interior antenna3(+)_output
14	Driver handle antenna switch_input	Rear center seat belt indicator_output	Immobilizer K-Line
15	P position_input (AT) -	-	Bumper antenna (+)_output
16	Fog switch_input	LF searching_output	Interior antenna2(+)_output
17	Light switch_input	Auto light sensor signal_input	IGN2_input
18	Front wiper INT volume switch_input	Auto light sensor power_output	IGN1_input
19	Multifunction switch_input	ATM solenoid_output	IGN2 relay_output
20	Right side mirror unfolding switch_oupout	Puddle pocket lamp_output	Battery_power
21	Right side mirror heater_output	-	Brake switch_input
22	Front washer switch_input	SSB ring illumination_output	Start feedback_input
23	Front wiper low switch_Input	piezo buzzer_output	Security indicator_output
24	LIN1 (PDW)	SSB symbol illumination_output	Interior1 (-)_output
25	LIN2 (Safety ECU)	3rd line sheet belt indicator_output	Driver outside handle antenna (-)_output
26	LIN3 (Rain sensor)	Wiper power relay_output	-
27	PDW power_input	Rear seat belt indicator RH_output	Passenger outside handle antenna (-)_output
28	PDW_input	Rear seat belt indicator LH_output	ESCL COM
29	SSB switch1_input	3rd line sheet belt indicator LH_output	Trunk Interior antenna3(-)_output
30	ESCL unlock_input	Rear wiper relay_output	ESCL Enable_output
31	Passenger outside handle switch_input	Auto light sensor ground_output	Bumper antenna (-)_output
32	PDW switch_input	Wiper parking switch_input	Interior antenna2 (-)_output
33	Sun roof Status_input		ACC_input
34	Head lamp switch_input		Mirror power_input
35	Front wiper switch_input		ACC relay_output
36	Rear wiper switch_input		ECU battery (+)
37	Mirror folding RH_output		
38	Mirror RH VT_output		

- Circuit Diagram

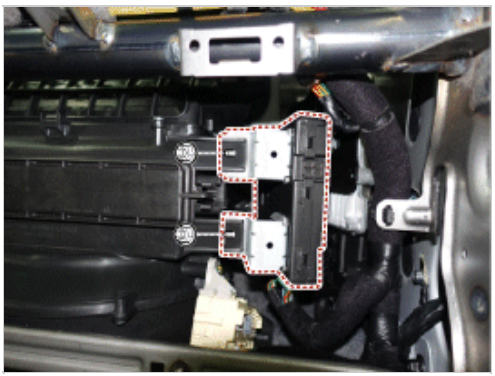

BAT
FUSE
B+_POWER
B+_ECU
C20
C26
VBD
Voltage regulator
VCC
VBB _WAKEUP
IBU SYSTEM
A31
GND_Power
B1
INT ANT
BLS (NORMAL OPEN)
L_BrakeSW_IN
C21
RF receiver (433.92Mhz 40Ihz_FSK
A_IGN1_IN
C18
A_IOC_IN
C23
A_IGN2_IN
C17
HS CAN
P_CAN_HIGH
A9
P+CAN_LOW
A8
HS-CAN Transceiver
RX
TX
HS CAN
B_CAN_HIGH
A12
B+CAN_LOW
A11
HS-CAN Transceiver
RX
TX
B+
HS Driver (4CH) #3
C34
V_MIRRORPower_IN
A37
L_RHMirrorFold_OUT
A20
L_RHMirrorUnFold_OUT
A21
L_RHMirrorHR_OUT
OPTION(DAU & -IMS)
A39
L_RHMirrorVT_OUT
OPTION(DAU & -IMS)
F
U
C
HR
LR
VR
UD
PAS OR RPAS
OPTION(RPAS OR PAS)
LIN1 (PAS)
A24
LIN Transceiver
RX
TX
SAFETY ECU
OPTION(SAFETY ECU)
LIN2 (Safety ECU)
A25
LIN Transceiver
RX
TX
RAIN SENSOR
OPTION(RAIN SENSOR)
LIN3 (RainSensor)
A26
LIN Transceiver
RX
TX
RRSEAT REMIND
OPTION(RRSEATREMIND)
LIN4 (UIP OR SIREN)
A7
LIN Transceiver
RX
TX
PAS
HS Driver (1CH) #9
A5
P_PAS_RPASSWIND_OUT
OPTION(PAS/RPAS)
LED
Vbb_WakeUP
A32
L_PAS_RPASSW_IN
OPTION(PAS/RPAS)
CONSOL SWITCH
A/LIGNHT SENSR & SECURITY INDICATOR
B+
LED
A_AutolightSNSRSIG_IN
B17
A_AutolightSNSRSIG_OUT
B31
V_AutolightSNSRPower_OUT
B18
OPTION(AUTO LIGHT)
Voltage Regulator
L_SecurityIND_OUT
B23
OPTION(BLARM)
LS Driver
IG1
A27
V_PAS_RPASPower_IN
HS Driver (2CH) #1
B2
V_FPASPower_OUT
OPTION(PAS)
FR PAS
A4
V_RPASPower_OUT
OPTION(PAS/RPAS)
RR PAS

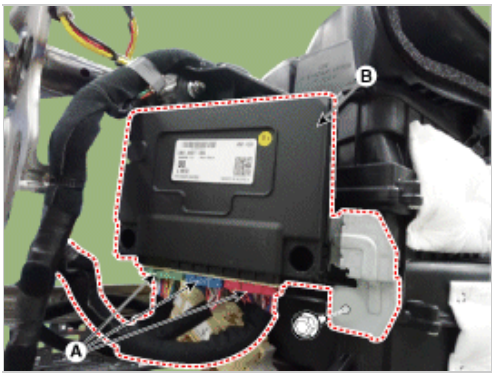


- Removal

Integrated Body Control Unit (IBU)

1. Disconnect the negative (-) battery terminal.
2. Remove the glove box housing.
   (Refer to Body - "Glove Box")
3. Disconnect the IBU connector (A).
4. Remove the IBU (B) after loosening mounting bolt and nuts.



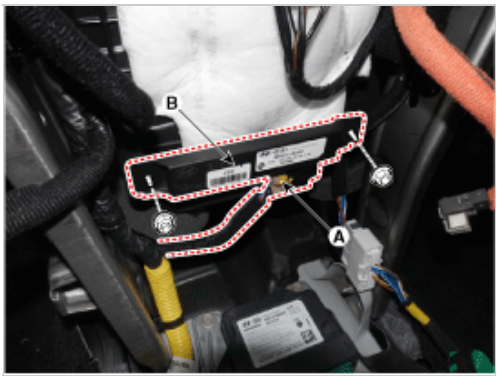


Interior 1 Antenna

NOTICE

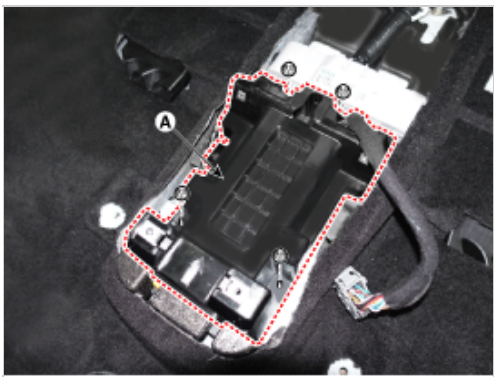
Take care not to scratch the crash pad and related parts.

1. Disconnect the negative (-) battery terminal.
2. Remove the console assembly.
   (Refer to Body - "Floor Console Assembly")
3. Remove the interior 1 antenna (B) after loosening the mounting nuts (2EA) and disconnecting the connector (A).

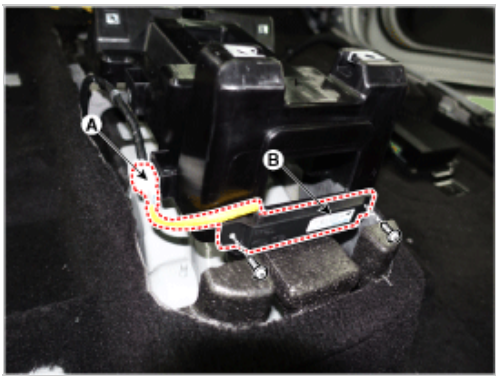


Interior 2 Antenna

1. Disconnect the negative (-) battery terminal.
2. Remove the console rear complete assembly.
   (Refer to Body - "Floor Console Assembly")
3. Remove the console duct (A).

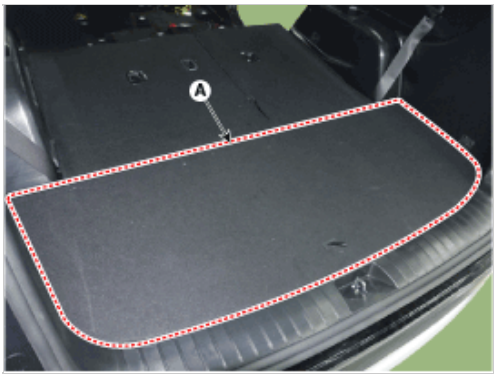


4. Remove the interior 2 antenna (B) after loosening the mounting nuts (2EA) and disconnecting the connector (A).

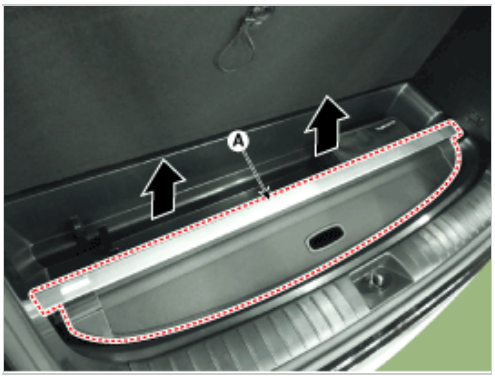


Interior 3 Antenna

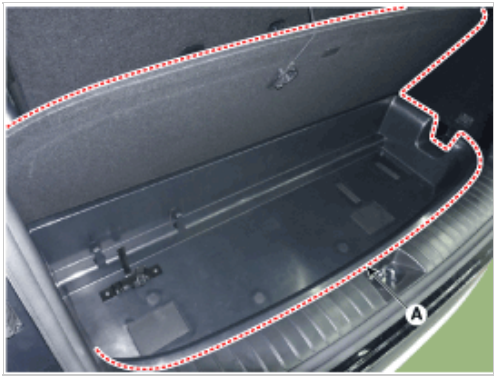
1. Disconnect the negative (-) battery terminal.
2. Remove the luggage floor box mat (A).



3. Remove the cago screen (A).



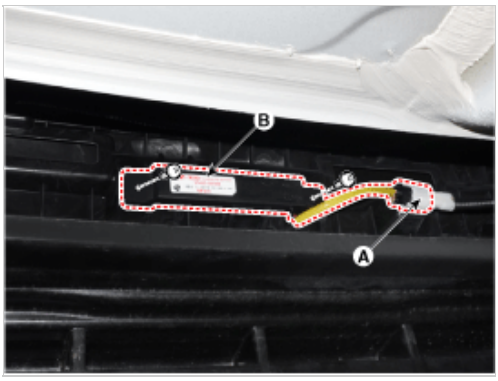
4. Remove the luggage floor box (A) after loosening mounting screws.



5. Remove the interior 3 antenna (B) after loosening mounting screws and disconnecting the connector (A).

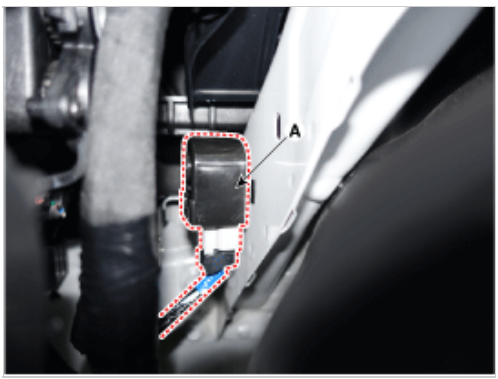
Exterior Bumper Antenna

1. Disconnect the negative (-) battery terminal.
2. Lift the vehicle.
3. Disconnect the antenna connector (A).
4. After loosening the nuts (2EA), remove the exterior bumper antenna (B).



Buzzer

1. Disconnect the negative (-) battery terminal.
2. Remove the front left wheel guard.
3. Disconnect the connectors, then remove the buzzer (A).



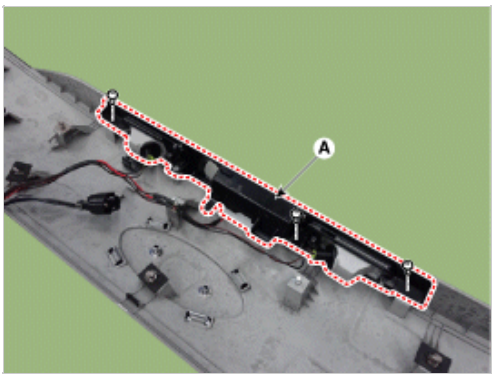
Door Outside Handle

1. Disconnect the negative (-) battery terminal.
2. Remove front door outside handle.
   (Refer to Body - "Front Door Outside Handle")

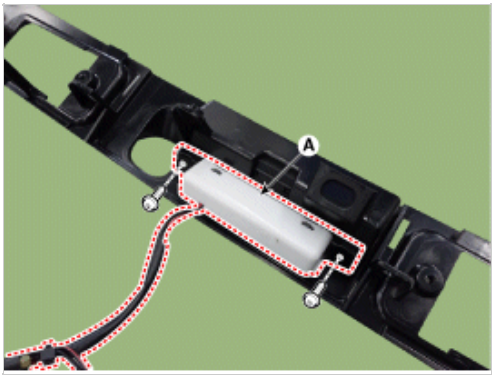
Tailgate Open Switch

1. Disconnect the negative (-) battery terminal.

2. Remove the tailgate back panel.
   (Refer to Body - "Tail Gate Back Panel")
3. Remove the tailgate switch assembly (A).



4. Remove the tailgate open switch (A) after loosening mounting screws.



- Inspection

Smart Key Unit

(Refer to Smart Key System - "Smart Key Diagnostic")

Smart Key Switch

(Refer to Smart Key System - "Smart Key Diagnostic")

Antenna

(Refer to Smart Key System - "Smart Key Diagnostic")

- Installation

Integrated Body Control Unit (IBU)

1. Install the IBU unit and connect the connector.
2. Install the driver side crash pad lower panel.
3. Install the negative (-) battery terminal and check the smart key system.

Interior 1 Antenna

1. Install the interior 1 antenna.
2. Install the floor console assembly.
3. Install the negative (-) battery terminal and check the smart key system.

Interior 2 Antenna

1. Install the interior 2 antenna.

2. Install the console rear complete assembly.
3. Install the negative (-) battery terminal and check the smart key system.

Interior 3 Antenna

1. Install the interior 3 antenna.
2. Install the luggage floor boxt, the cago screen, the luggage floor box mat.
3. Install the negative (-) battery terminal and check the smart key system.

Exterior Bumper Antenna

1. Install the exterior bumper antenna.
2. Install the rear bumper cover.
3. Install the negative (-) battery terminal and check the smart key system.

Buzzer

1. Install the buzzer.
2. Install the front left wheel guard.
3. Install the negative (-) battery terminal and check the smart key system.

Door Outside Handle

1. Install the outside handle.
2. Install the door trim.
3. Install the negative (-) battery terminal and check the smart key system.

Tailgate Switch

1. Install the tailgate open switch.
2. Install the tailgate back panel.
3. Install the negative (-) battery terminal and check the smart key system.

- Inspection

Self Diagnosis With Scan Tool

It will be able to diagnose defects of SMART KEY system with Diagnostic tool quickly. Diagnostic tool can operates actuator forcefully, input/output value monitoring and self diagnosis.
The following three features will be major problem in SMART KEY system.

1. Problem in SMART KEY unit input.
2. Problem in SMART KEY unit.
3. Problem in SMART KEY unit output.

So the following three diagnosis operates will be the major problem solution process.

1. SMART KEY unit Input problem : switch diagnosis
2. SMART KEY unit problem : communication diagnosis
3. SMART KEY unit Output problem : antenna and switch output diagnosis

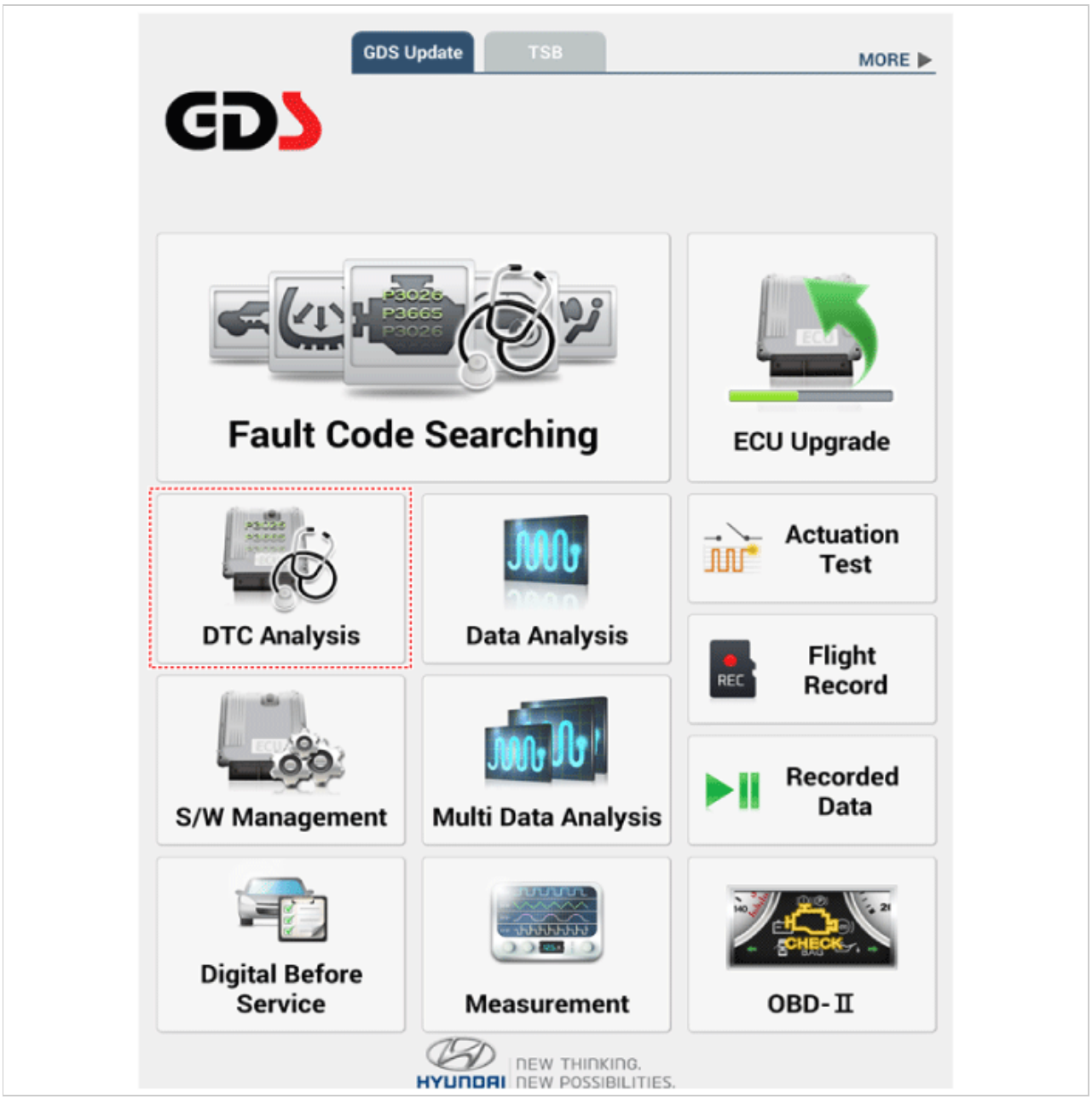
Switch Diagnosis

1. In the body electrical system, failure can be quickly diagnosed by using the vehicle diagnostic system (Diagnostic tool).
   The diagnostic system(Diagnostic tool) provides the following information.
   (1) Fault Code Searching : Checking failure and code number (DTC)
   (2) Data Analysis : Checking the system input/output data state

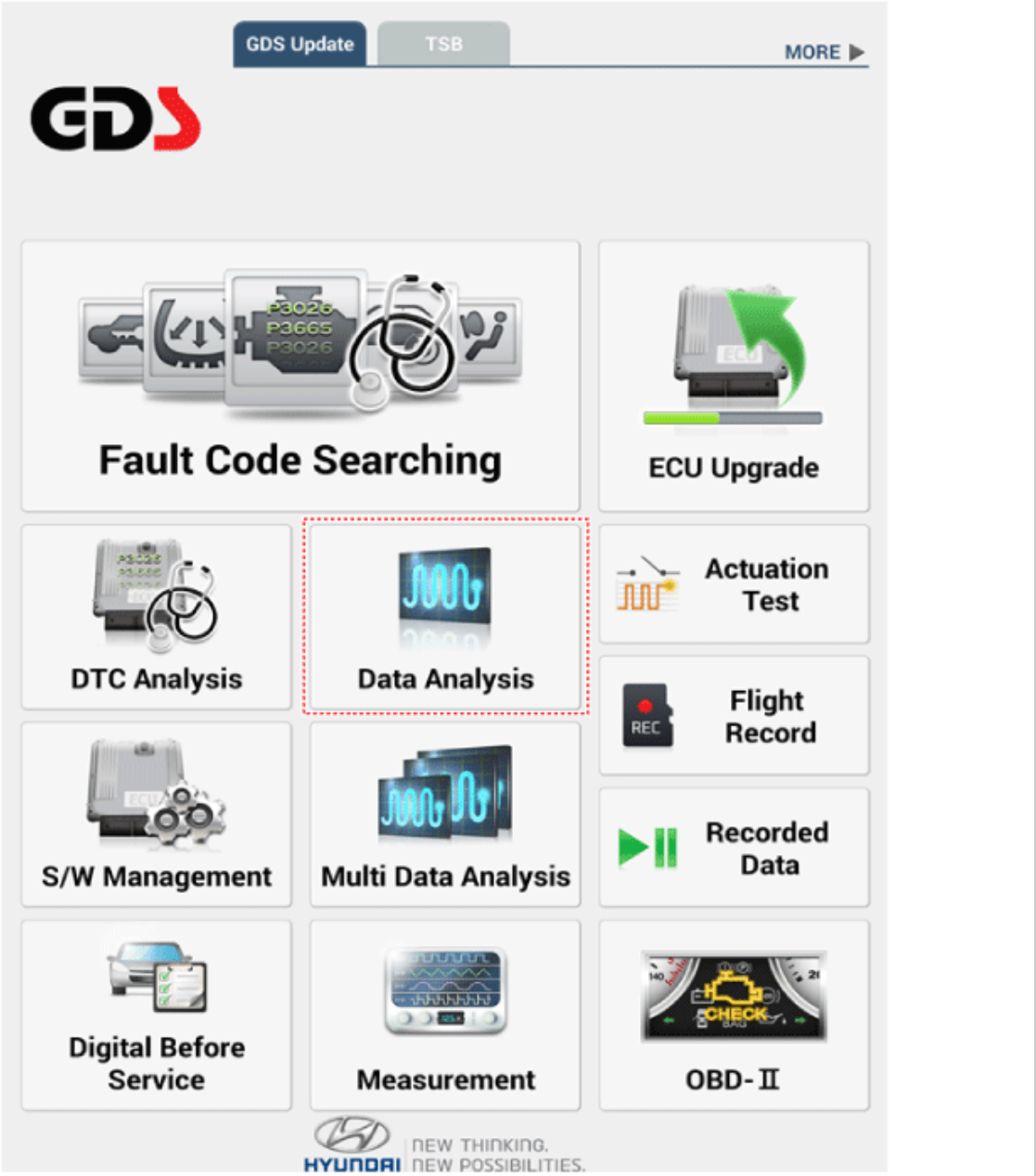
(3) Actuation test : Checking the system operation condition

(4) S/W Management : Controlling other features including system option setting and zero point adjustment

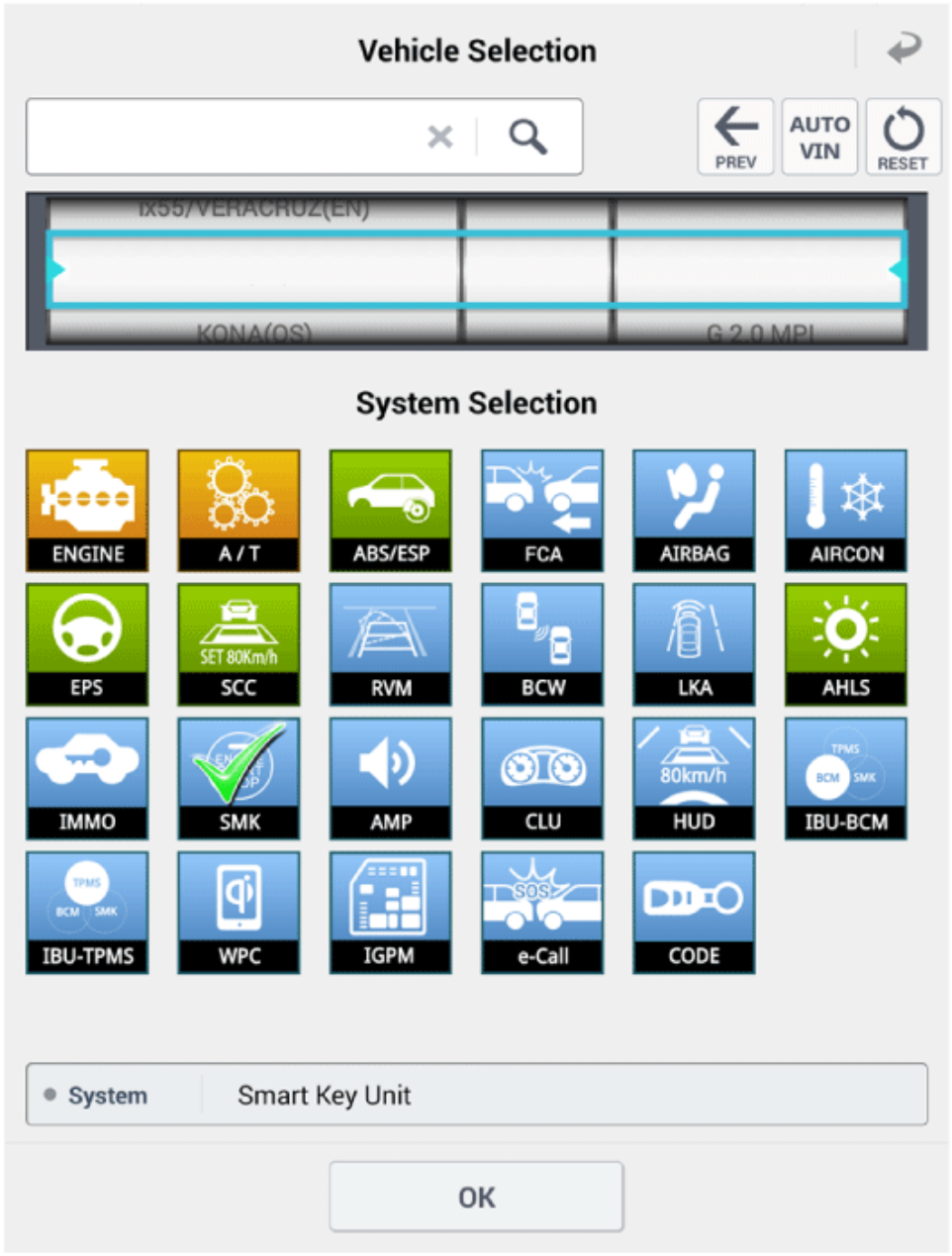
2. If diagnose the vehicle by Diagnostic tool, select "DTC Analysis" and "Vehicle".

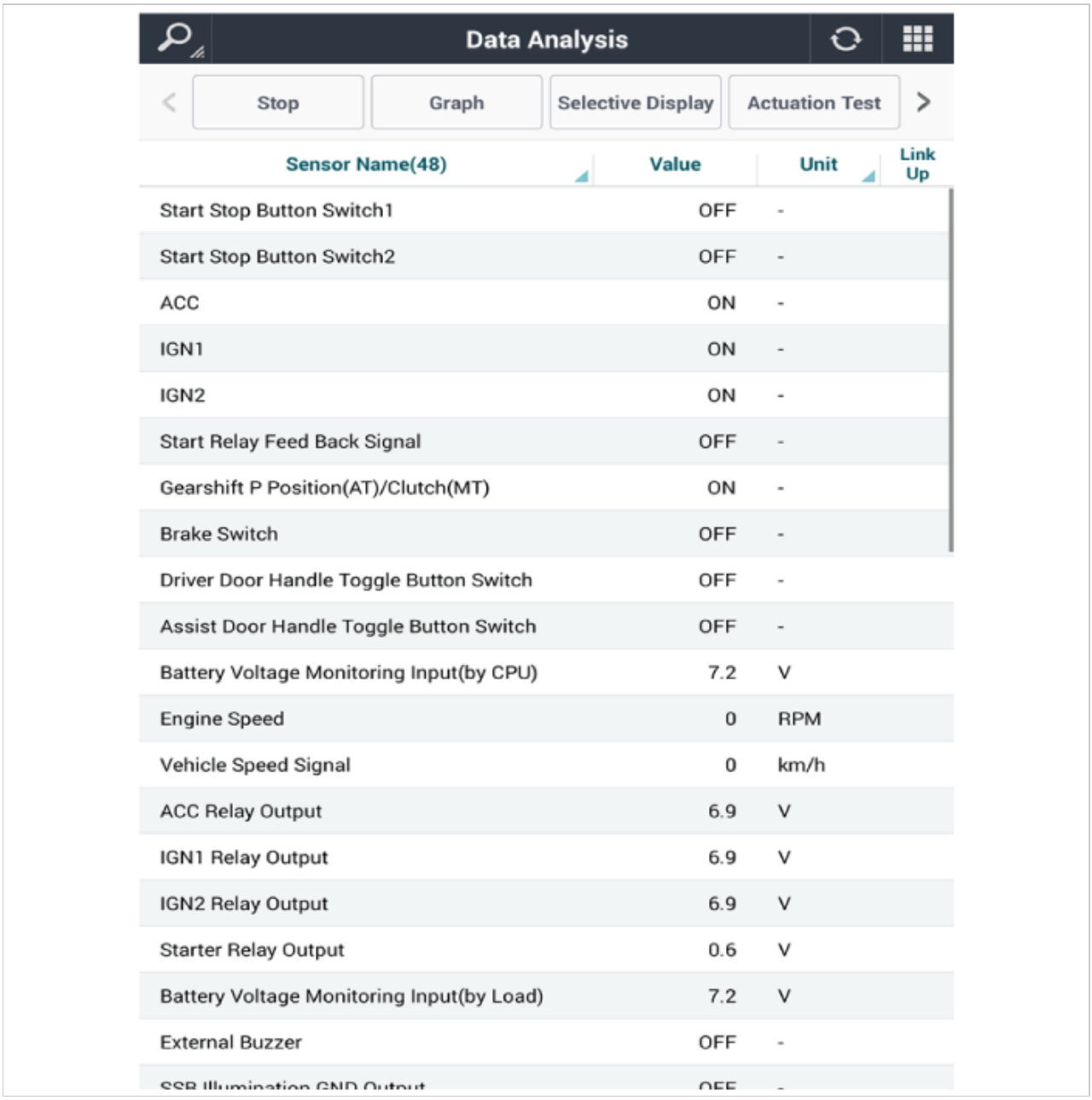


3. If check current status, select the "Data Analysis" and "Car model".



4. Select the SMK' to be checked in order to check the vehicle with the tester.


Vehicle Selection
PREV
AUTO VIN
RESET
IX55/VERACRUZ(EN)
KONA(OS)
G 2.0 MPI
System Selection
ENGINE
A / T
ABS/ESP
FCA
AIRBAG
AIRCON
EPS
SET 80Km/h
SCC
RVM
BCW
LKA
AHLS
IMMO
SMK
AMP
CLU
80km/h
HUD
TPMS
BCM
SMK
IBU-BCM
IBU-TPMS
WPC
IGPM
SOS
e-Call
CODE
System
Smart Key Unit
OK

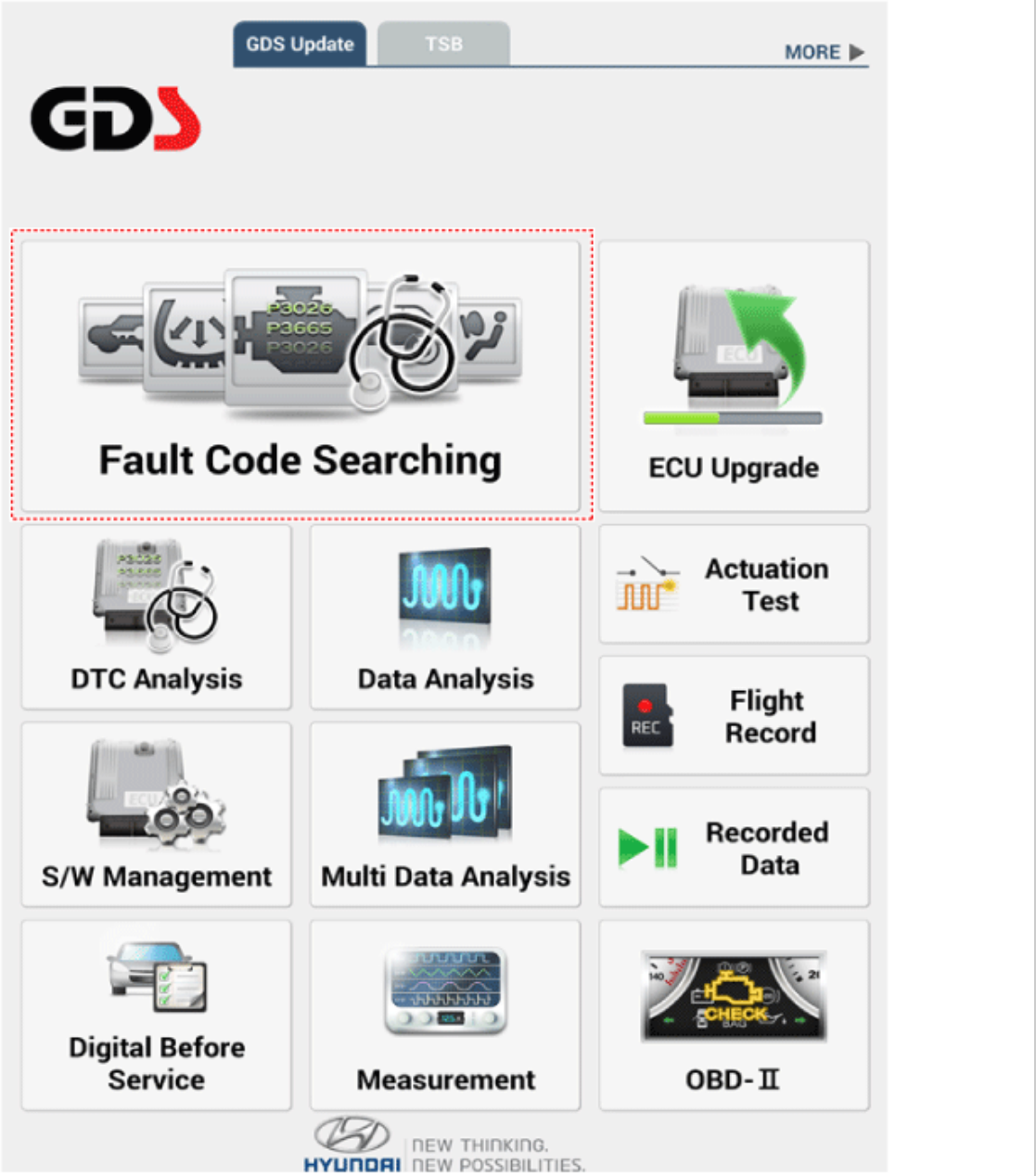

Data Analysis
Stop
Graph
Selective Display
Actuation Test
Sensor Name(48)
Value
Unit
Link Up
Start Stop Button Switch1 OFF -
Start Stop Button Switch2 OFF -
ACC ON -
IGN1 ON -
IGN2 ON -
Start Relay Feed Back Signal OFF -
Gearshift P Position(AT)/Clutch(MT) ON -
Brake Switch OFF -
Driver Door Handle Toggle Button Switch OFF -
Assist Door Handle Toggle Button Switch OFF -
Battery Voltage Monitoring Input(by CPU) 7.2 V
Engine Speed 0 RPM
Vehicle Speed Signal 0 km/h
ACC Relay Output 6.9 V
IGN1 Relay Output 6.9 V
IGN2 Relay Output 6.9 V
Starter Relay Output 0.6 V
Battery Voltage Monitoring Input(by Load) 7.2 V
External Buzzer OFF -

5. You can see the situation of each switch on scanner after connecting the "current data" process.

Display	Description
FL Toggle SW	ON : Push button is ON in the driver door handle.
FR Toggle SW	ON : Push button is ON in the assist door handle.
Tailgate open SW	ON : Tailgate button is ON.
Gear P Position	ON : Shift lever is P position.
IGN 1	ON : IGN switch is IG position.
ACC	ON : IGN switch is ACC position.
Brake SW	ON : Brake switch is ON.

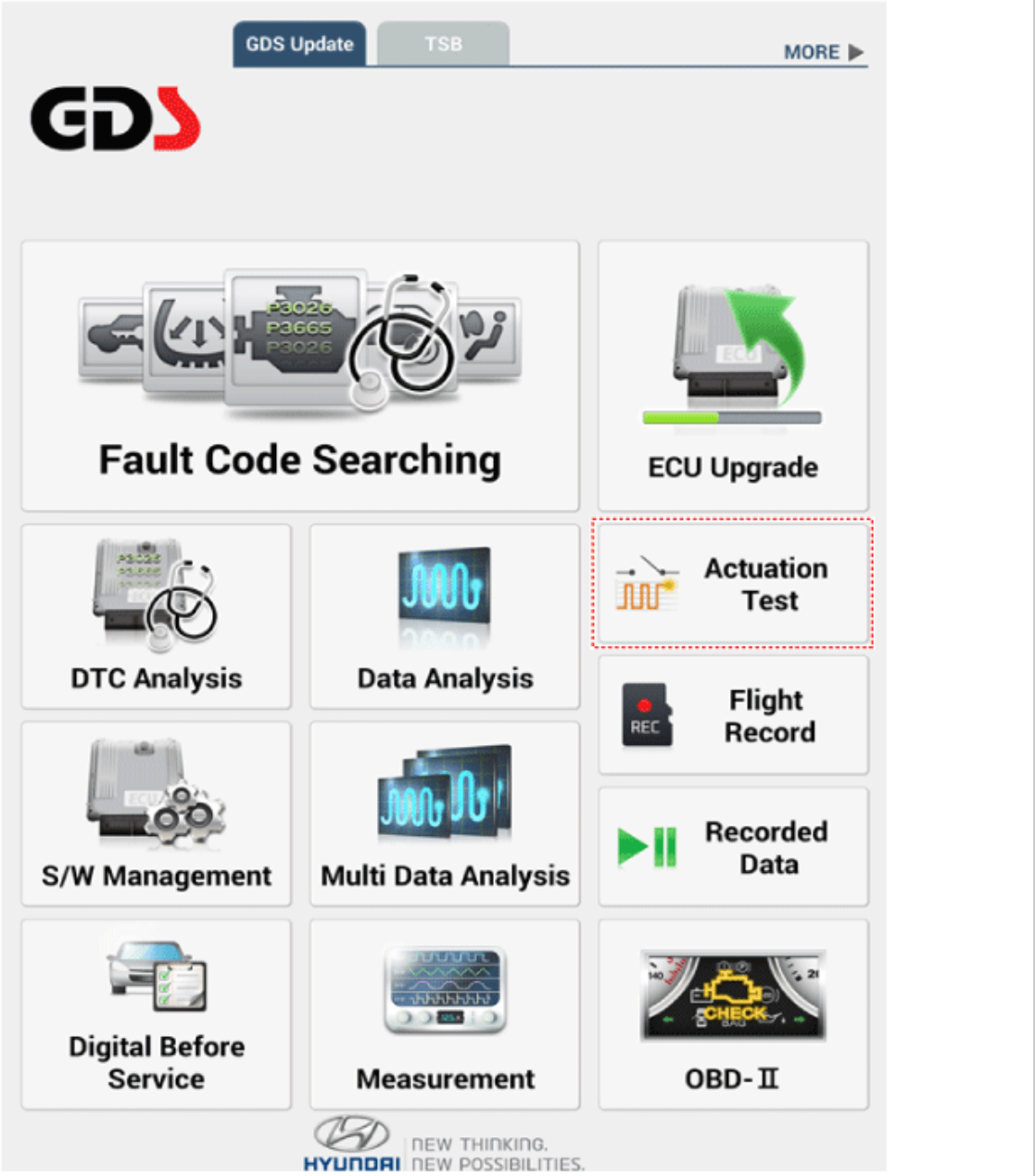
Fault Code Searching

1. Fault code searching that the each linked components operates normal.
2. Connect the cable of Diagnostic tool to the data link connector in driver side crash pad lower panel.
3. Select the 'Fault Code Searching' and 'Car model'.

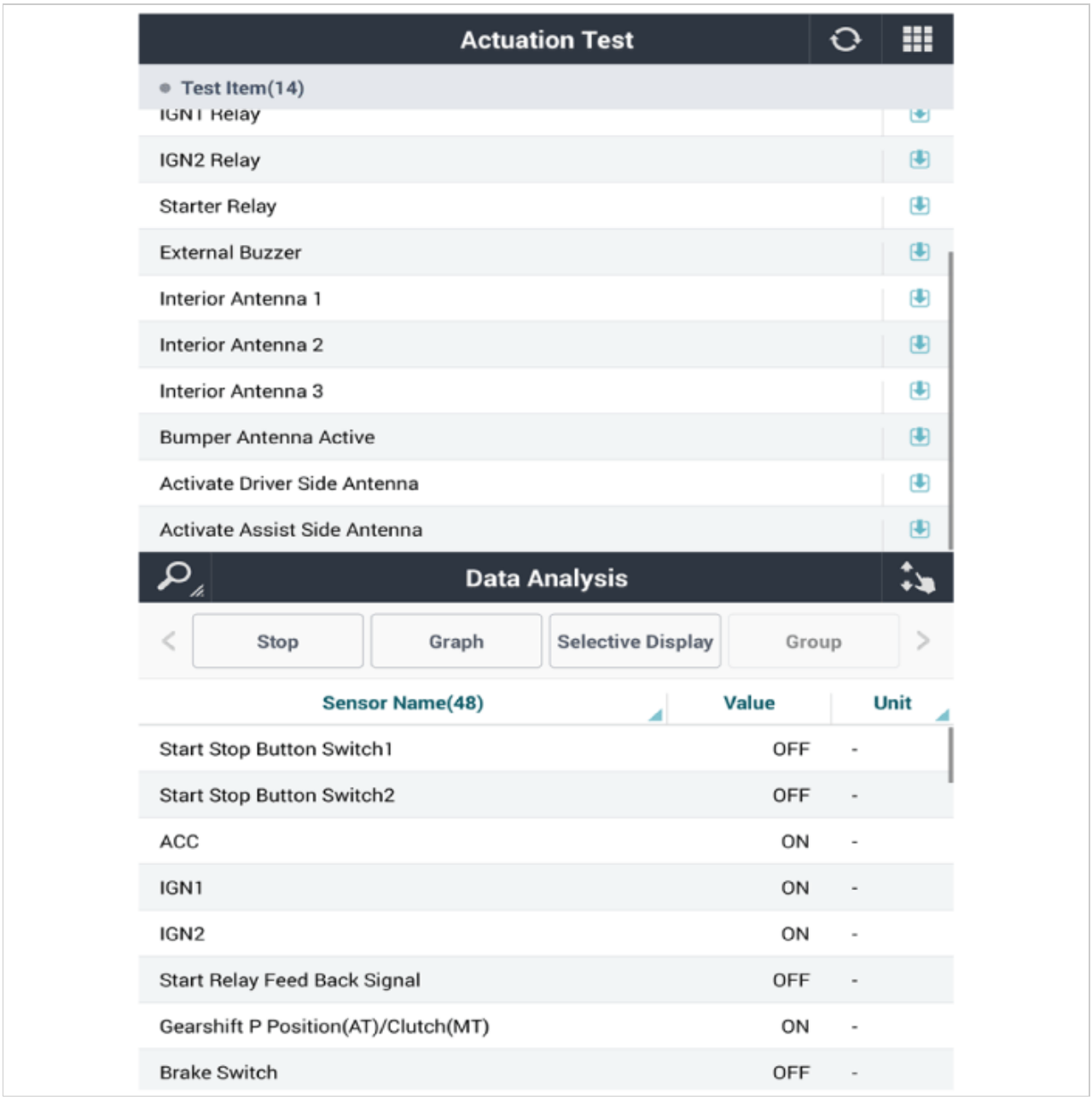


Antenna Actuation Diagnosis

1. Connect the cable of Diagnostic tool to the data link connector in driver side crash pad lower panel.
2. Select the 'Actuation Test' and 'Car model'.



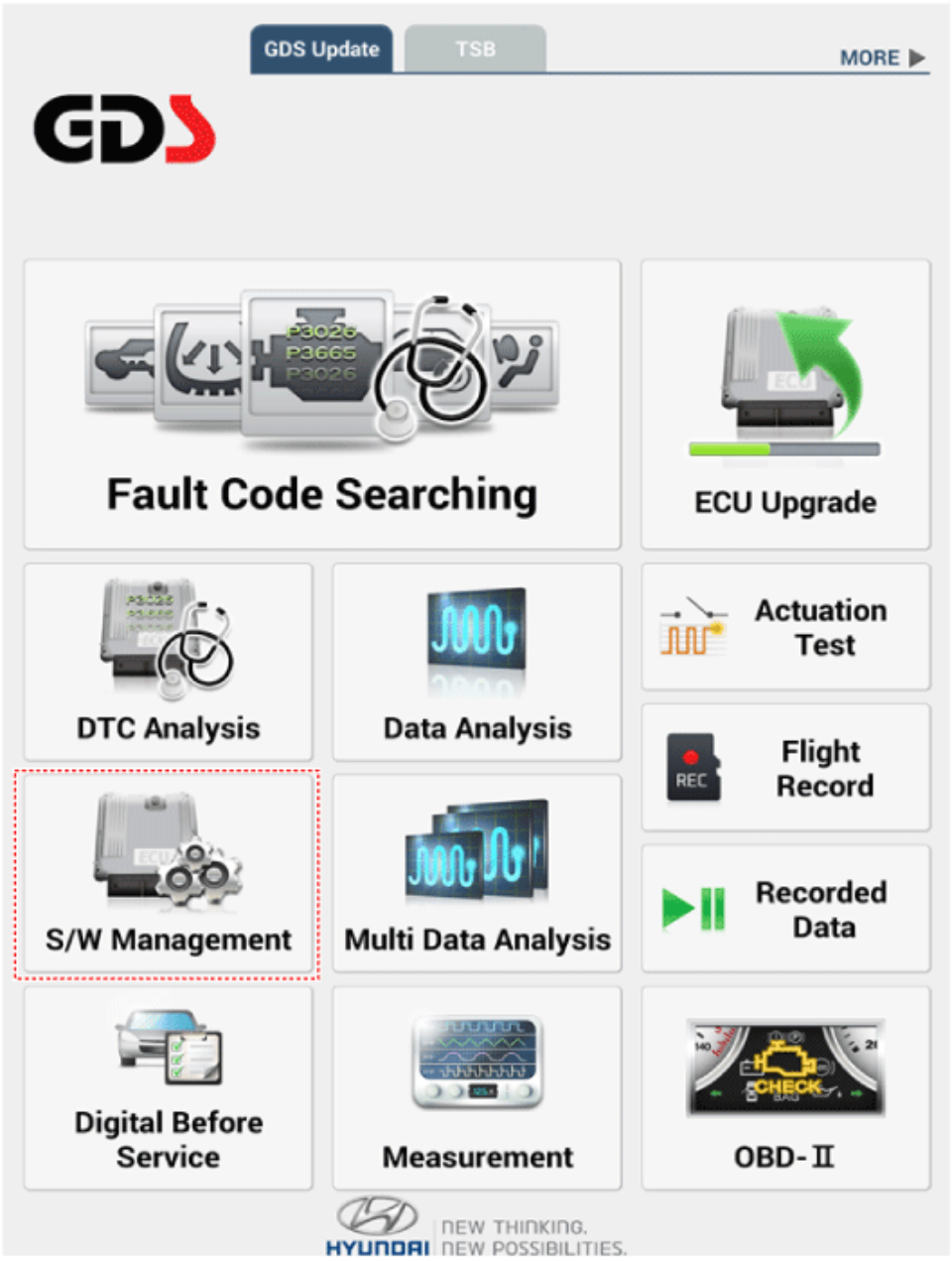
3. Set the smart key near the related antenna and operate it with a Diagnostic tool.



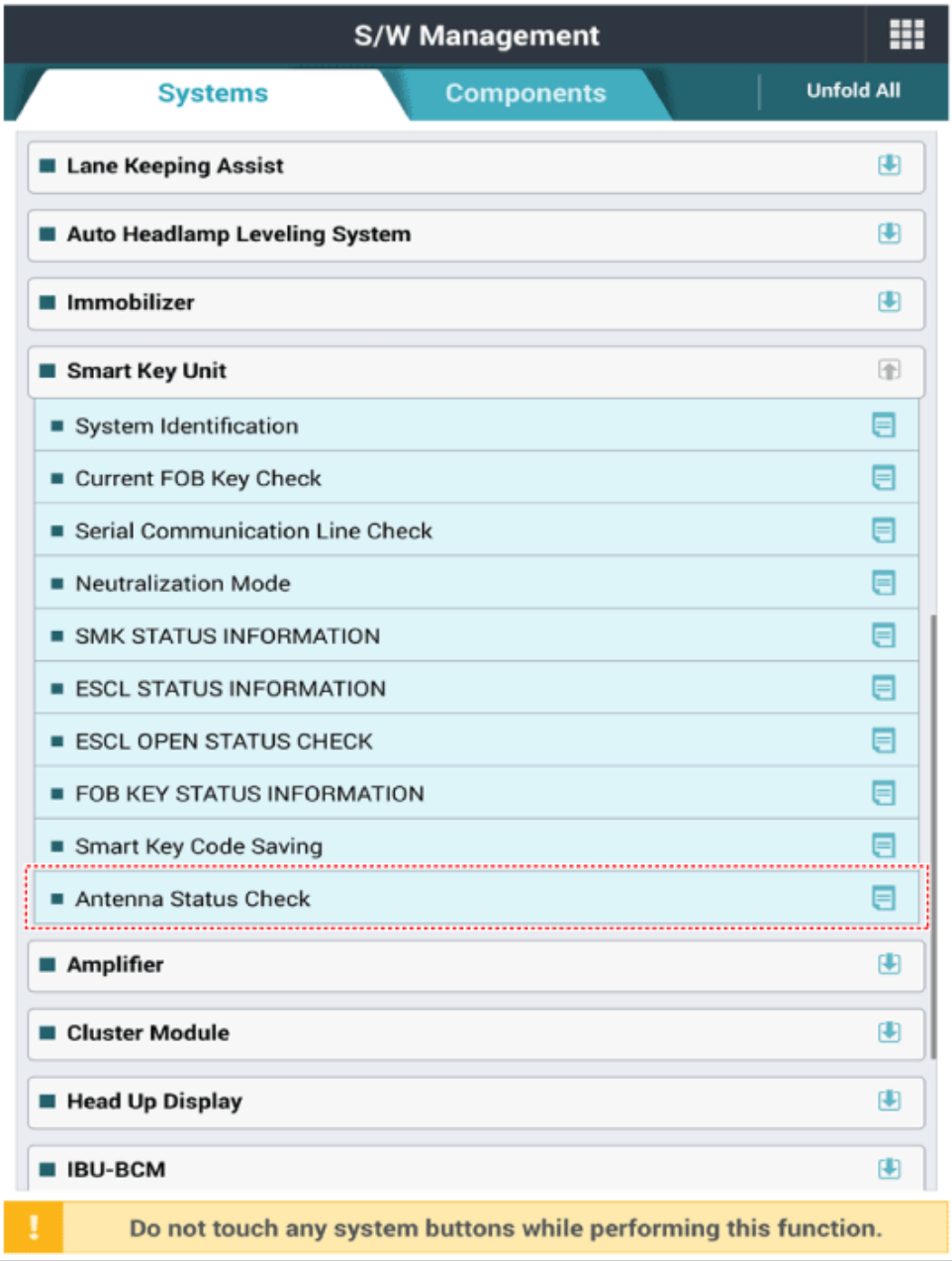
4. Set the smart key near the related antenna and operate it with a Diagnostic tool.
5. If the LED of smart key is blinking, the smart key is normal.
6. If the LED of smart key is not blinking, check the voltage of smart key battery.
7. Antenna actuation
   - Interior Antenna 1
   - Interior Antenna 2
   - Bumper Antenna
   - Driver Door Antenna
   - Assist Door Antenna

Antenna Status Check

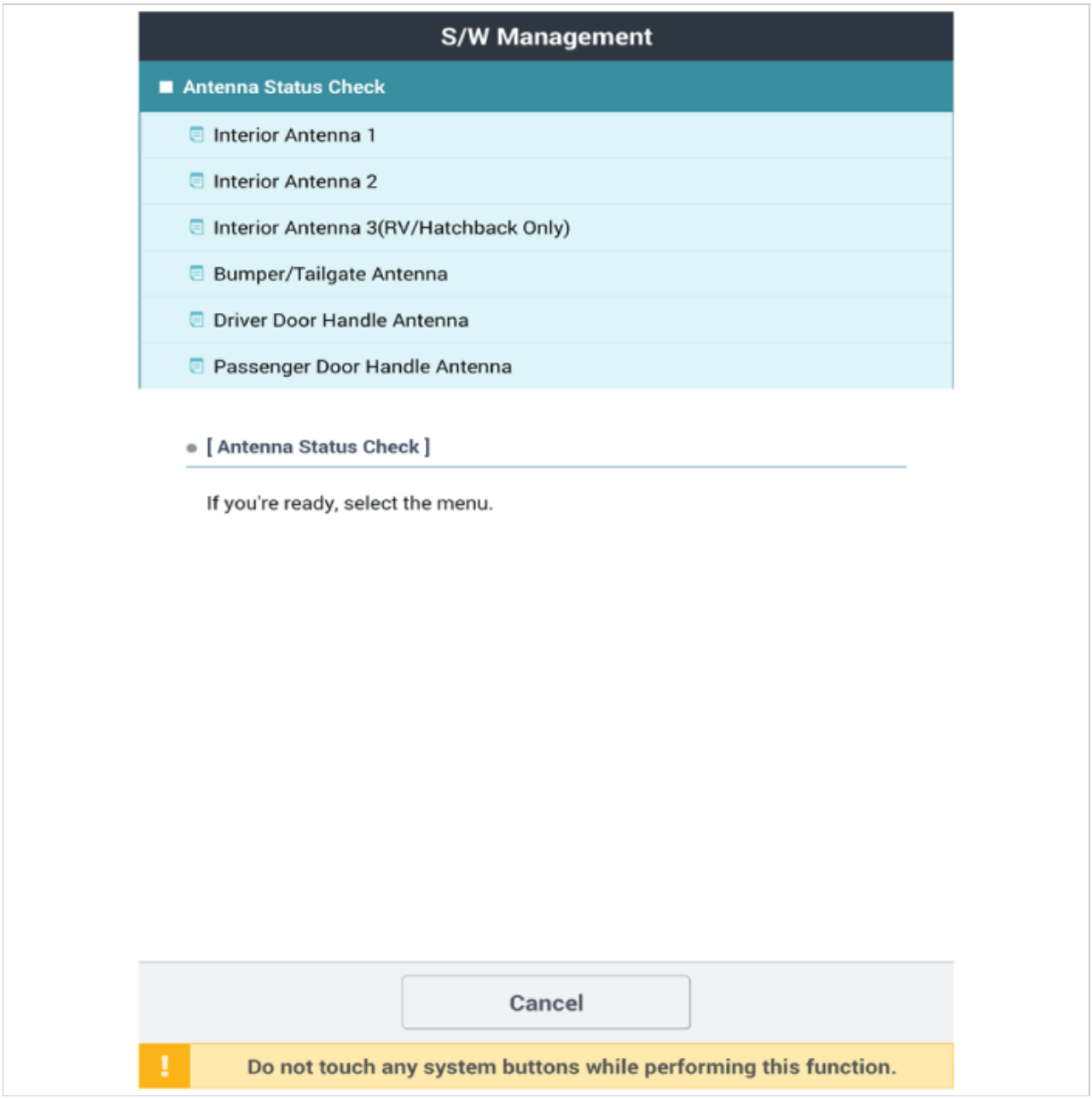
1. Connect the cable of Diagnostic tool to the data link connector in driver side crash pad lower panel.
2. Select the 'S/W Management' and 'Car model'.



3. Select the 'Smart Key Unit' and 'Antenna Status Check'.



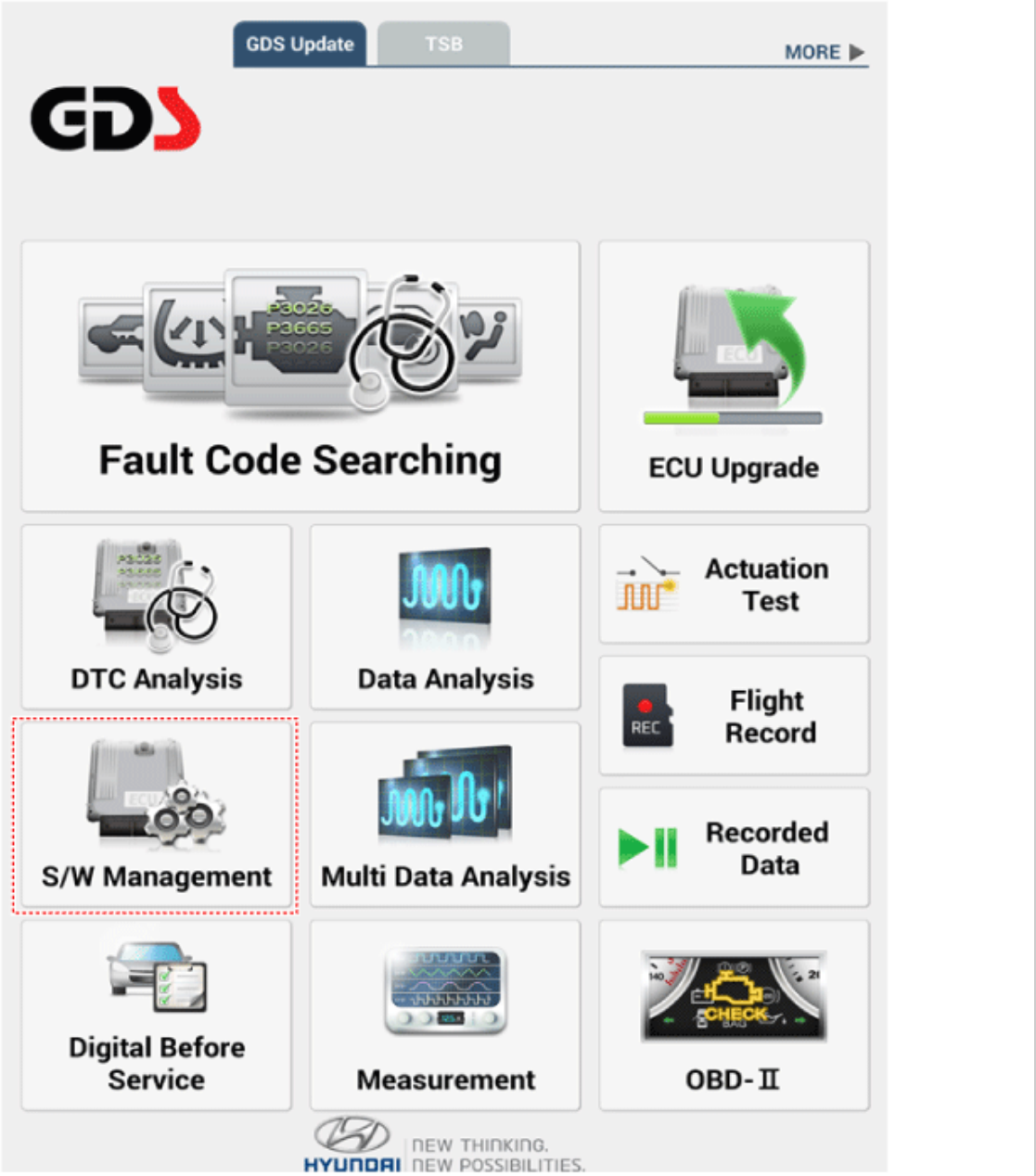
4. Set the smart key near the related antenna and operate it with a Diagnostic tool.



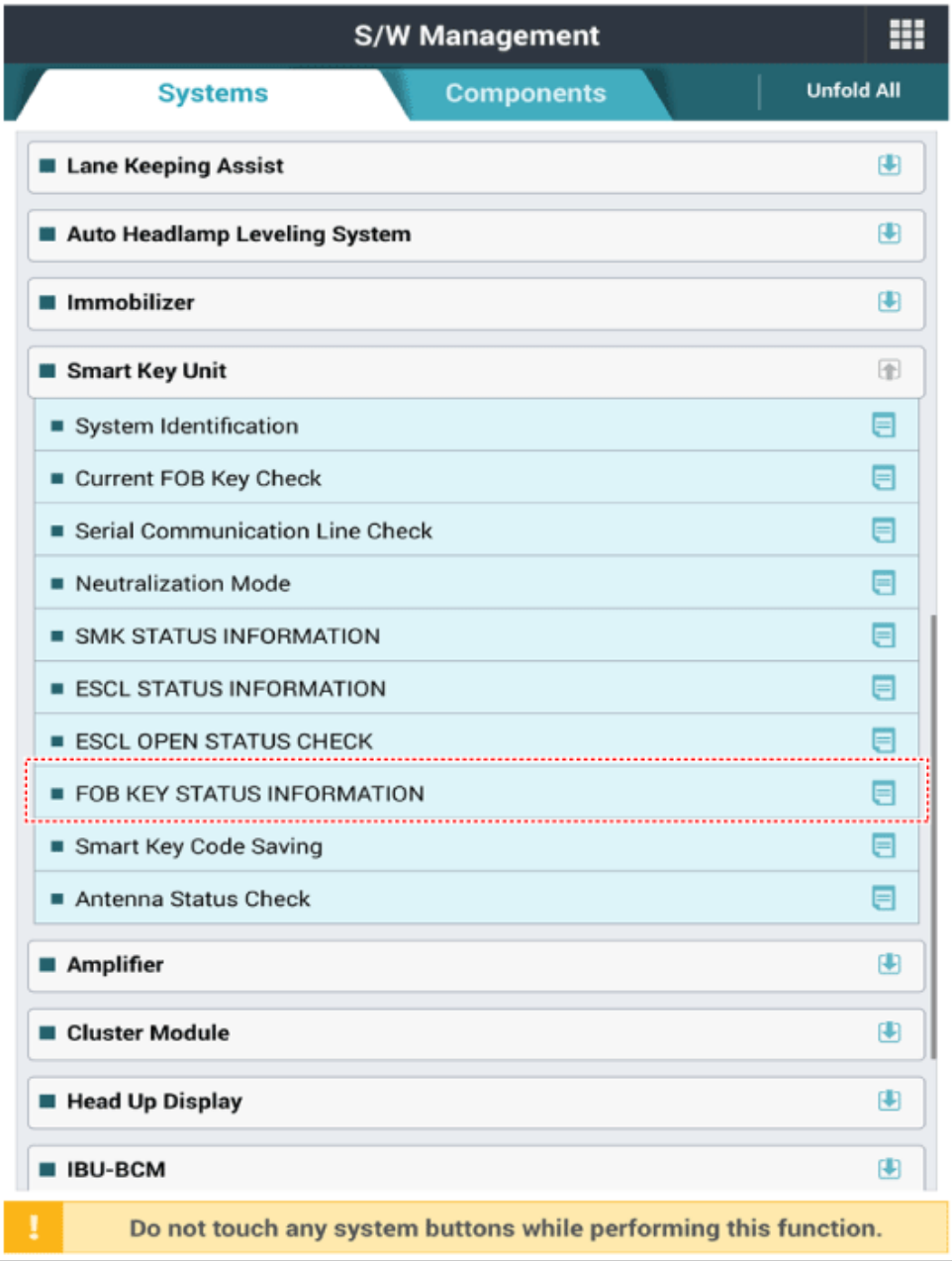
5. If the smart key runs normal , the related antenna, smart key (transmission, reception) and exterior receiver are normal.
6. Antenna status
   - Interior Antenna 1
   - Interior Antenna 2
   - Bumper Antenna
   - Driver Door Antenna
   - Assist Door Antenna

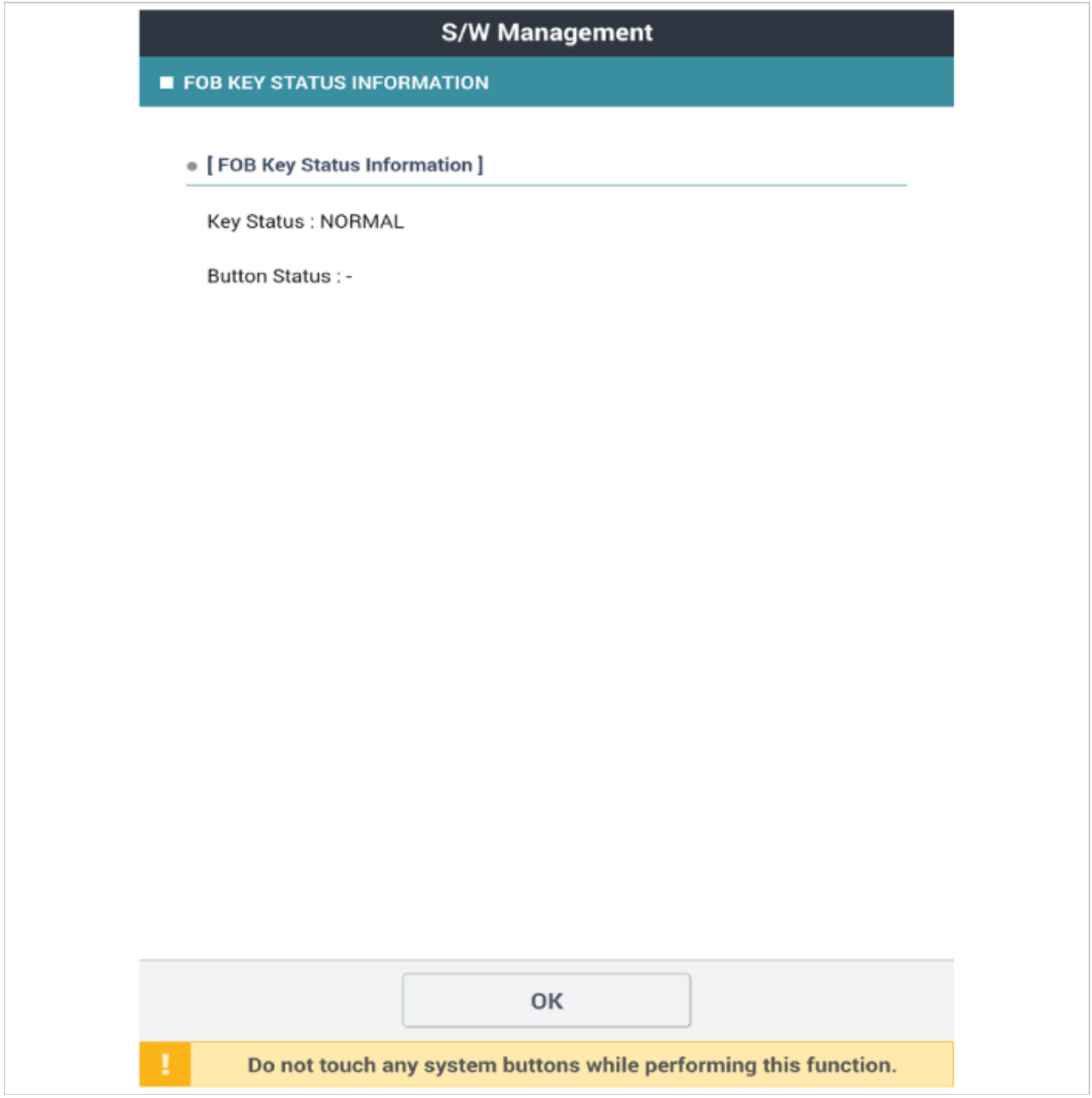
FOB Status Check

1. Connect the cable of Diagnostic tool to the data link connector in driver side crash pad lower panel.
2. Select the 'S/W Management' and 'Car model'.



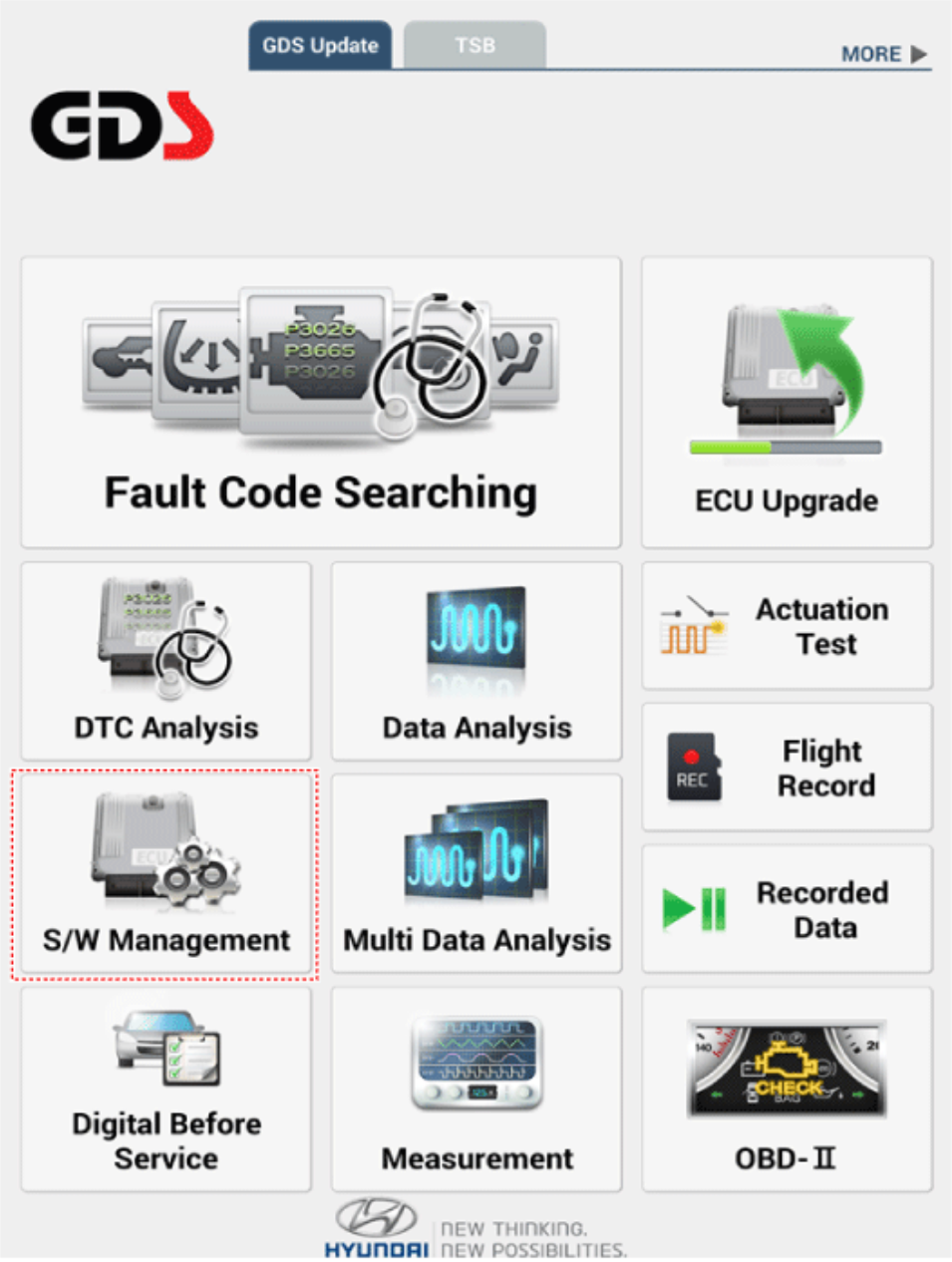
3. Select the 'Smart Key Unit' and 'FOB KEY STATUS IMFORMATION'.


S/W Management
Systems
Components
Unfold All
Lane Keeping Assist
Auto Headlamp Leveling System
Immobilizer
Smart Key Unit
System Identification
Current FOB Key Check
Serial Communication Line Check
Neutralization Mode
SMK STATUS INFORMATION
ESCL STATUS INFORMATION
ESCL OPEN STATUS CHECK
FOB KEY STATUS INFORMATION
Smart Key Code Saving
Antenna Status Check
Amplifier
Cluster Module
Head Up Display
IBU-BCM
Do not touch any system buttons while performing this function.

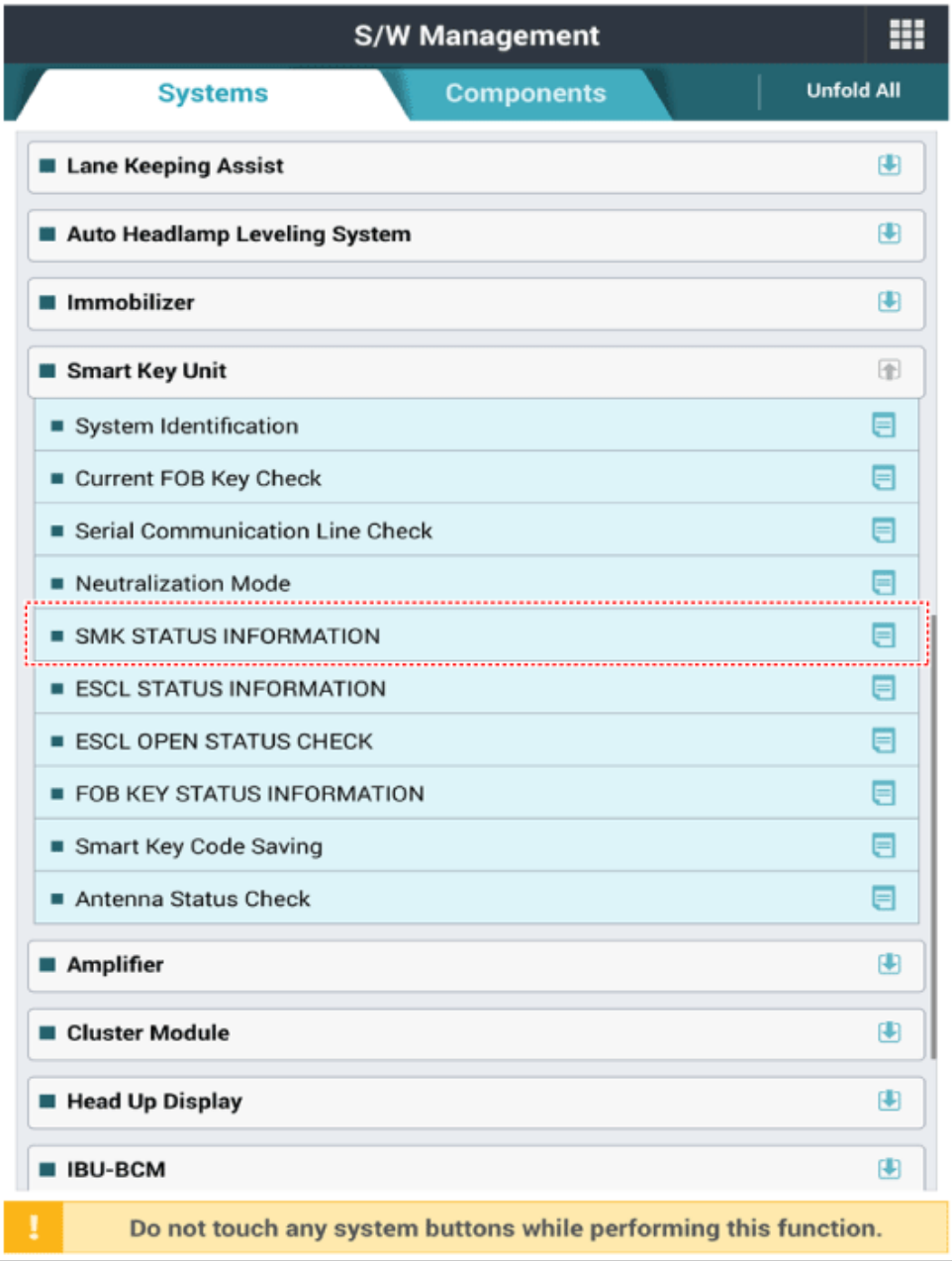

S/W Management
FOB KEY STATUS INFORMATION
[FOB Key Status Information]
Key Status : NORMAL
Button Status : -
OK
Do not touch any system buttons while performing this function.

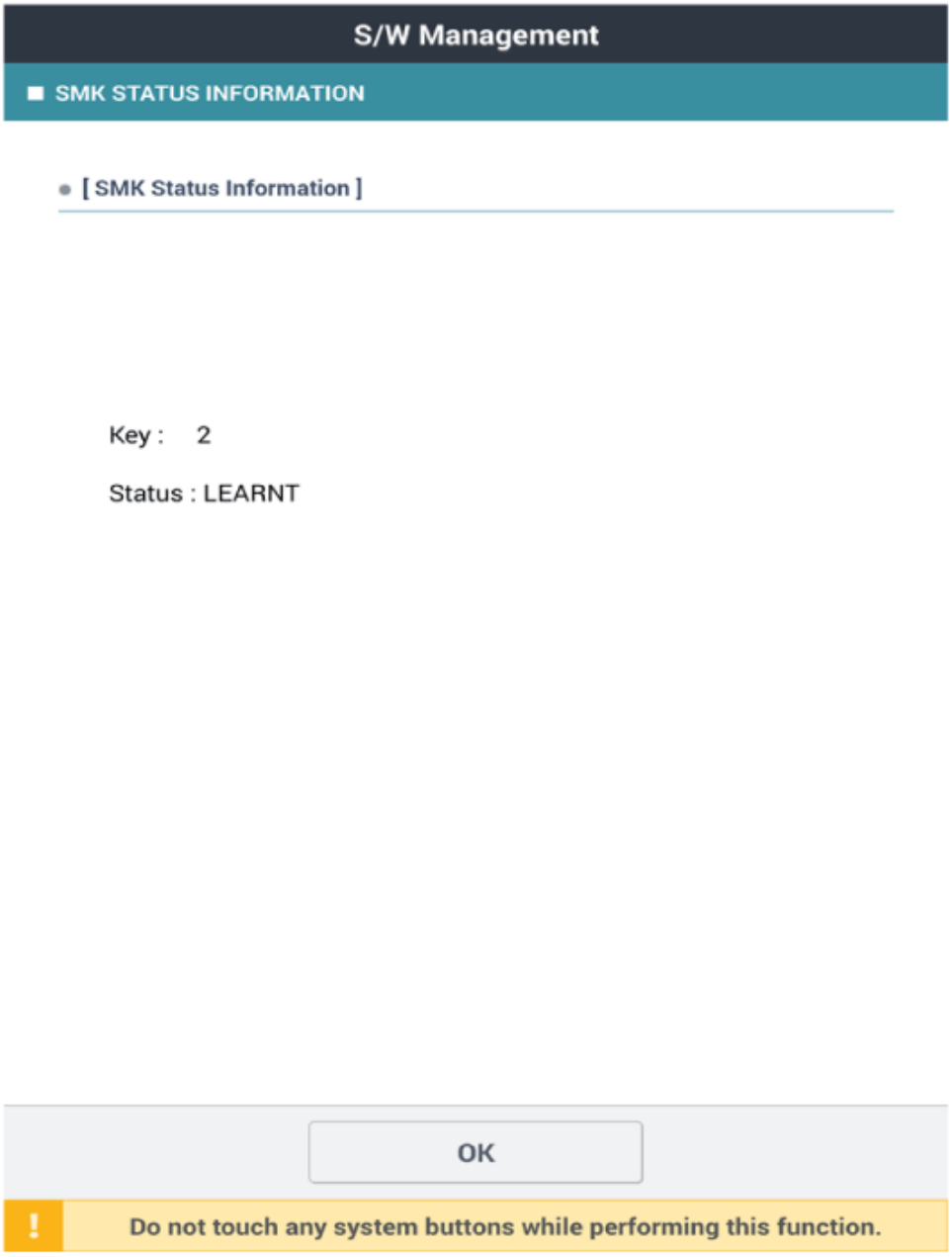
Smart Key Status Check

1. Connect the cable of Diagnostic tool to the data link connector in driver side crash pad lower panel.
2. Select the 'S/W Management' and 'Car model'.



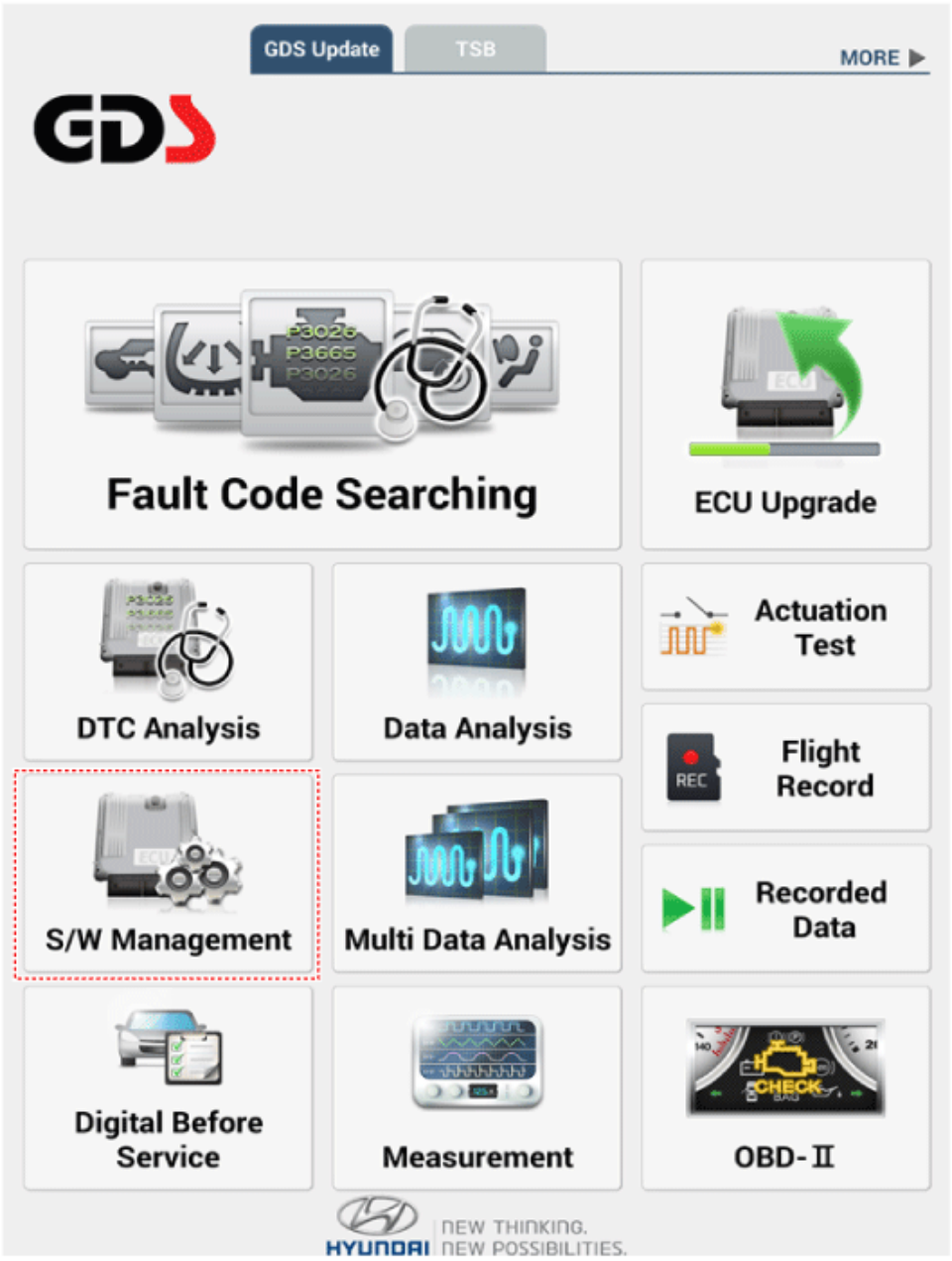
3. Select the 'Smart Key Unit' and 'SMK STATUS INFORMATION'.


S/W Management
Systems
Components
Unfold All
Lane Keeping Assist
Auto Headlamp Leveling System
Immobilizer
Smart Key Unit
System Identification
Current FOB Key Check
Serial Communication Line Check
Neutralization Mode
SMK STATUS INFORMATION
ESCL STATUS INFORMATION
ESCL OPEN STATUS CHECK
FOB KEY STATUS INFORMATION
Smart Key Code Saving
Antenna Status Check
Amplifier
Cluster Module
Head Up Display
IBU-BCM
Do not touch any system buttons while performing this function.

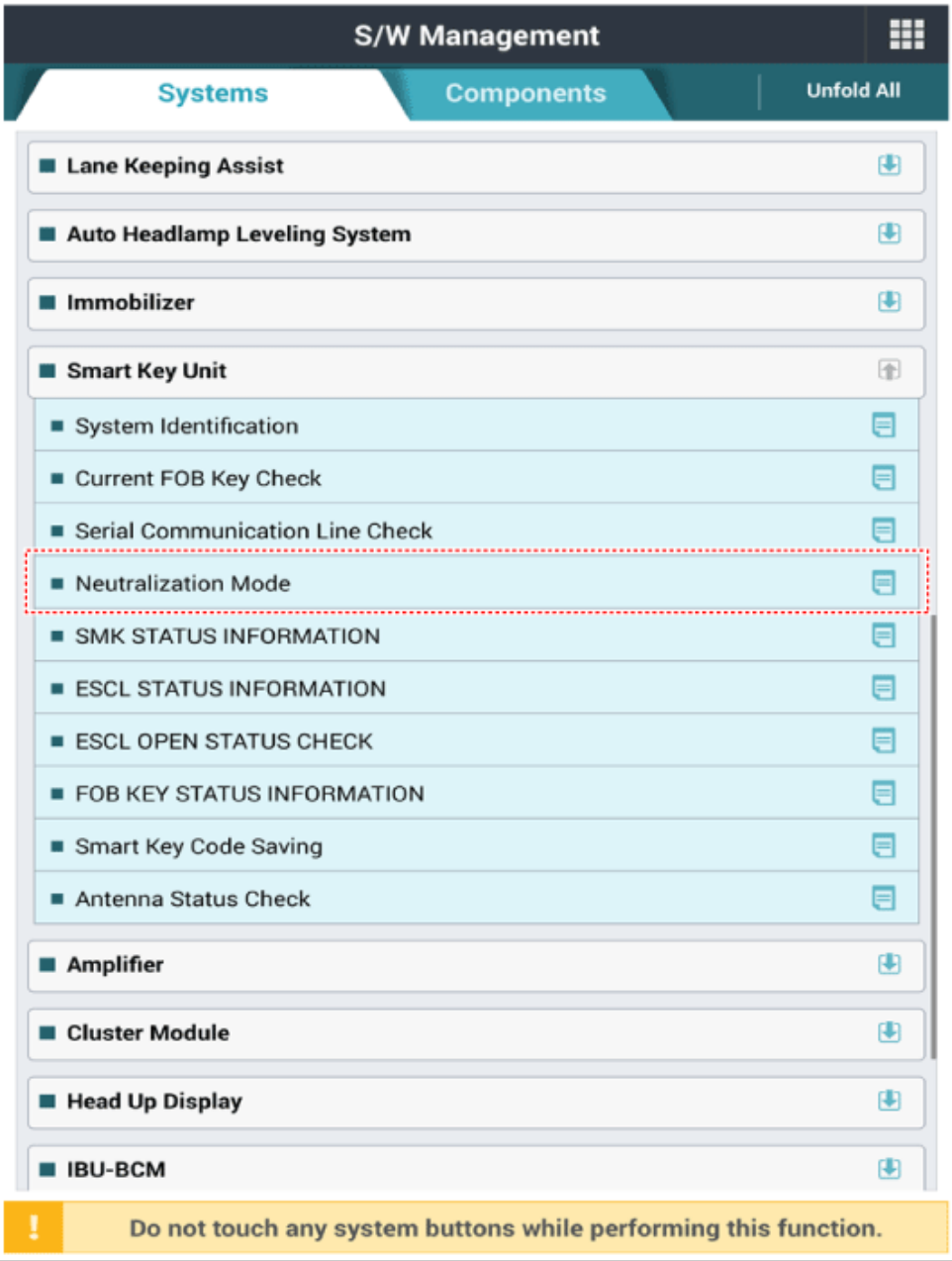


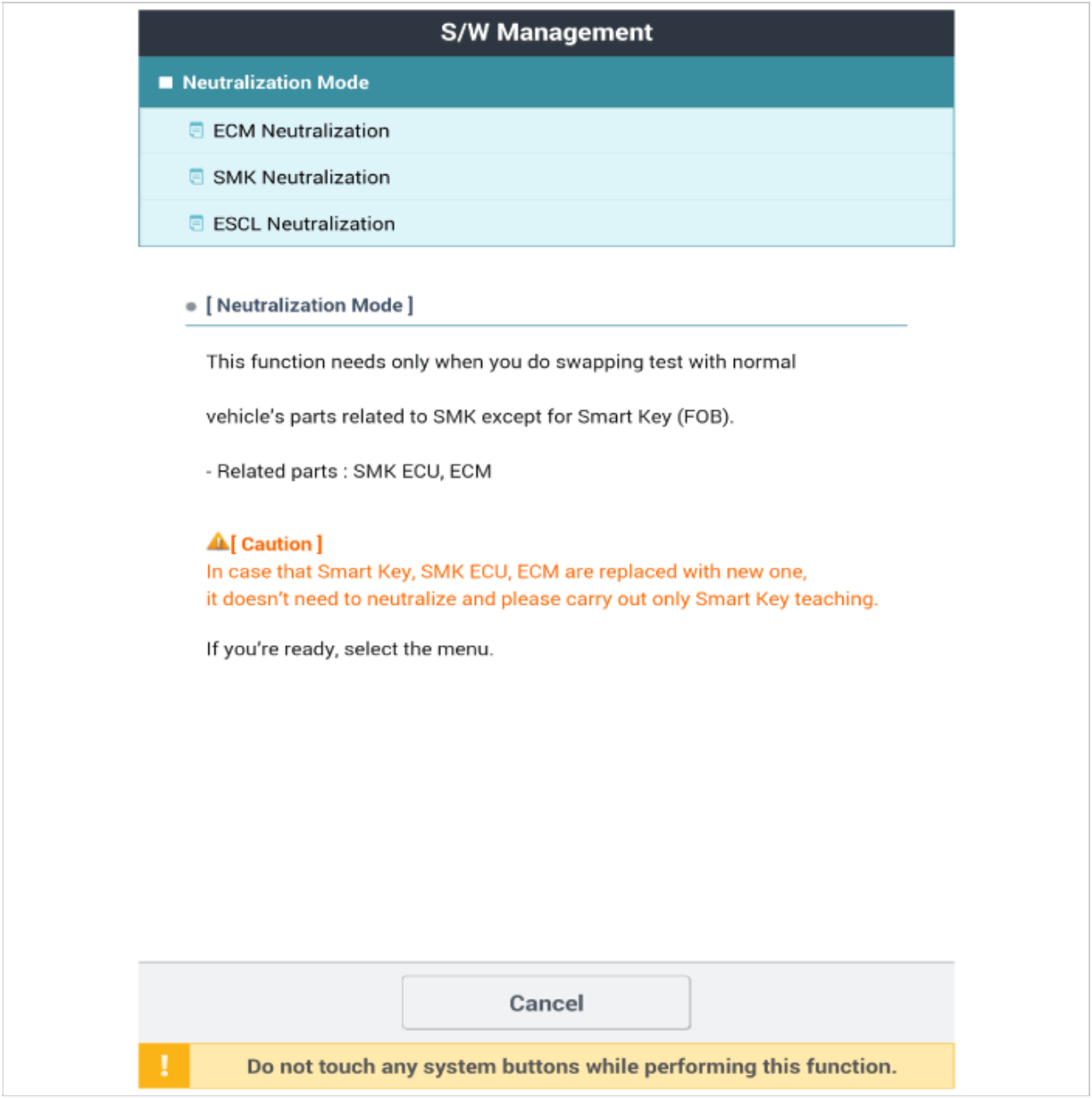
Neutralization Status Check

1. Connect the cable of Diagnostic tool to the data link connector in driver side crash pad lower panel.
2. Select the 'S/W Management' and 'Car model'.



3. Select the 'Smart Key Unit' and 'Neutralization Mode'.


S/W Management
Systems
Components
Unfold All
Lane Keeping Assist
Auto Headlamp Leveling System
Immobilizer
Smart Key Unit
System Identification
Current FOB Key Check
Serial Communication Line Check
Neutralization Mode
SMK STATUS INFORMATION
ESCL STATUS INFORMATION
ESCL OPEN STATUS CHECK
FOB KEY STATUS INFORMATION
Smart Key Code Saving
Antenna Status Check
Amplifier
Cluster Module
Head Up Display
IBU-BCM
Do not touch any system buttons while performing this function.

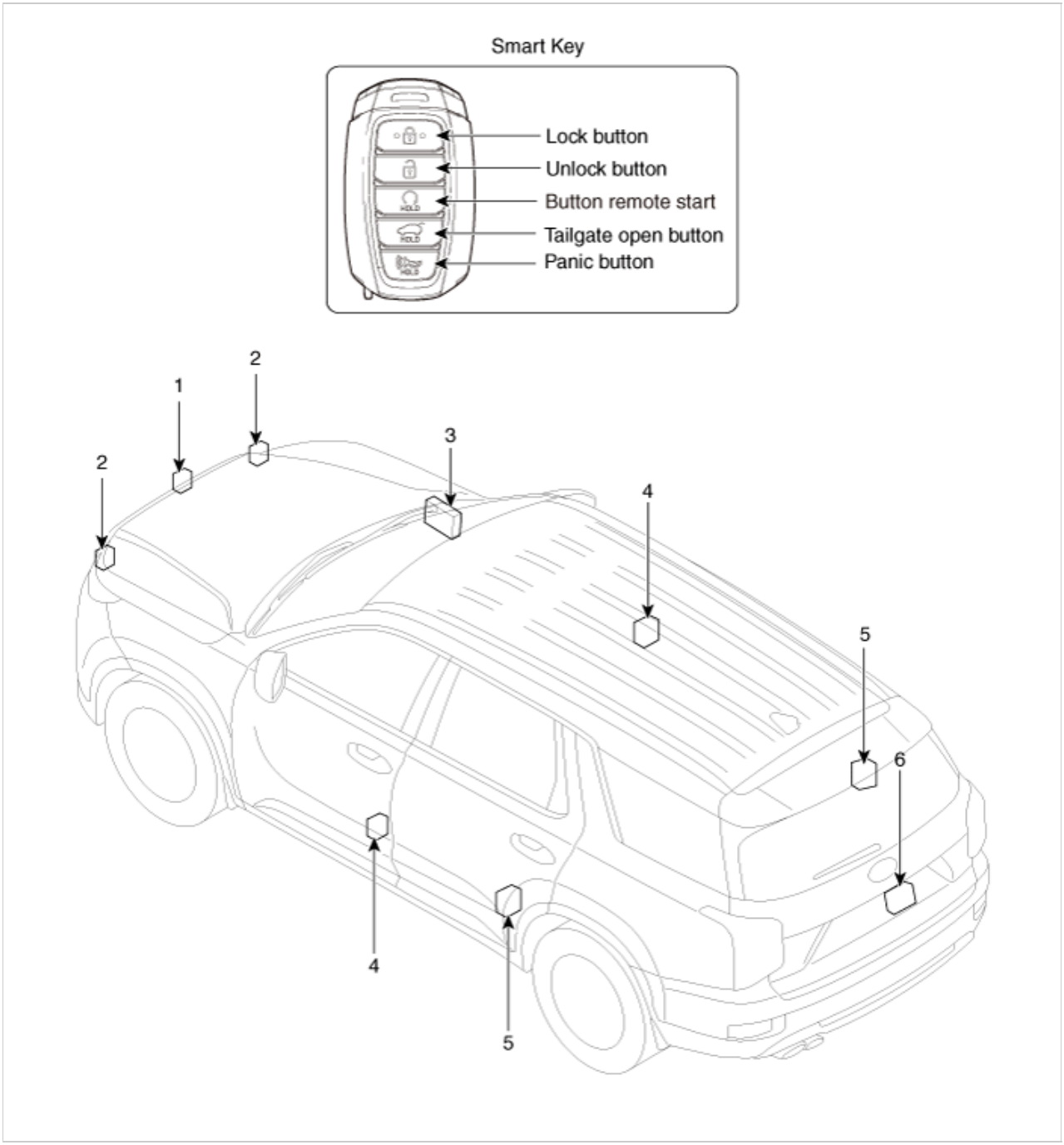

S/W Management
Neutralization Mode
ECM Neutralization
SMK Neutralization
ESCL Neutralization
[Neutralization Mode]
This function needs only when you do swapping test with normal
vehicle's parts related to SMK except for Smart Key (FOB).
- Related parts : SMK ECU, ECM
[Caution]
In case that Smart Key, SMK ECU, ECM are replaced with new one,
it doesn't need to neutralize and please carry out only Smart Key teaching.
If you're ready, select the menu.
Cancel
Do not touch any system buttons while performing this function.

- Specification

Item	Specification
Power source	3V
Operating temperature	-20°C to +60°C (-4°F to- +140°F)
RF Modulation	FSK
LF Modulation	ASK
RF frequency	433.92MHz
Battery	CR2032
Transmissible distance	10m or more
Life of battery	2years or more (at 20 times per day)
Button number	5
Function	Door lock
	Door unlock
	Tailgate unlock
	Panic

	Button remote start

- Component Location



1. Hood switch
2. Horn
3. Intergrated Body Control Unit (IBU)
4. Front door lock actuator & switch
5. Rear door lock actuator & switch
6. Tailgate open switch

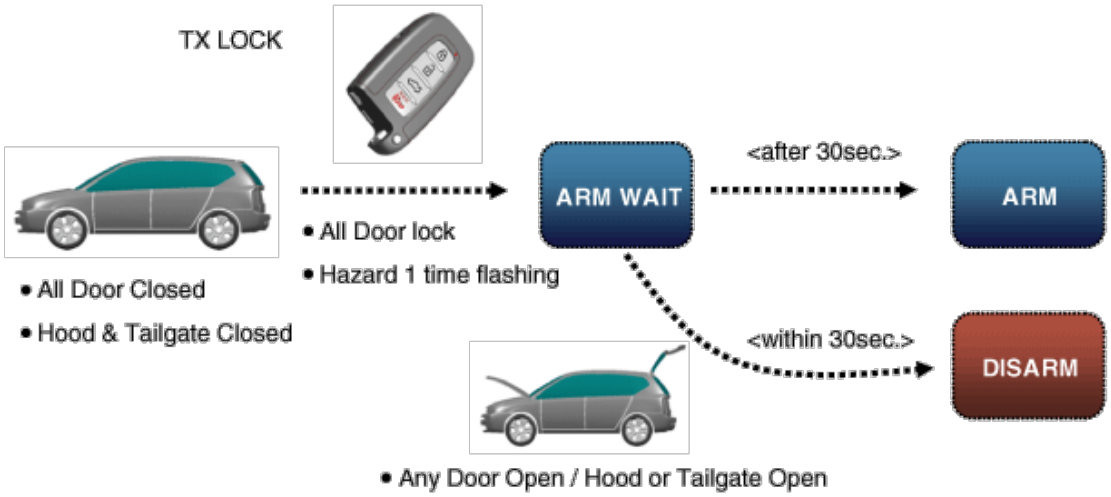
- Description

Burglar Alarm State [B/A State]

B/A State	Description

DISARM	1) In "DISARM" state, no vehicle start inhibition. So, when door, hood, or Tailgate is opened, there is no alarm sound and flashing. 2) If the battery is disconnected while the state is not "ARM/ARMWAIT/ALARM/REARM", B/A state is set to "DISARM" state. 3) In "DISARM" state, security indicator keeps blinking.
ARMWAIT	1) In "ARMWAIT" state, when timer "30sec." is running, if this timer reaches "30sec", state transits to "ARM" state. 2) If the battery is disconnected while the state is "ARMWAIT", B/A state is set to "ARMWAIT" state and timer "30sec" is restarted. 3) In "ARMWAIT" state, security indicator keeps on.

[ARM WAIT Procedure]



※ Remark : On Smart key system, it works the same way with passive lock

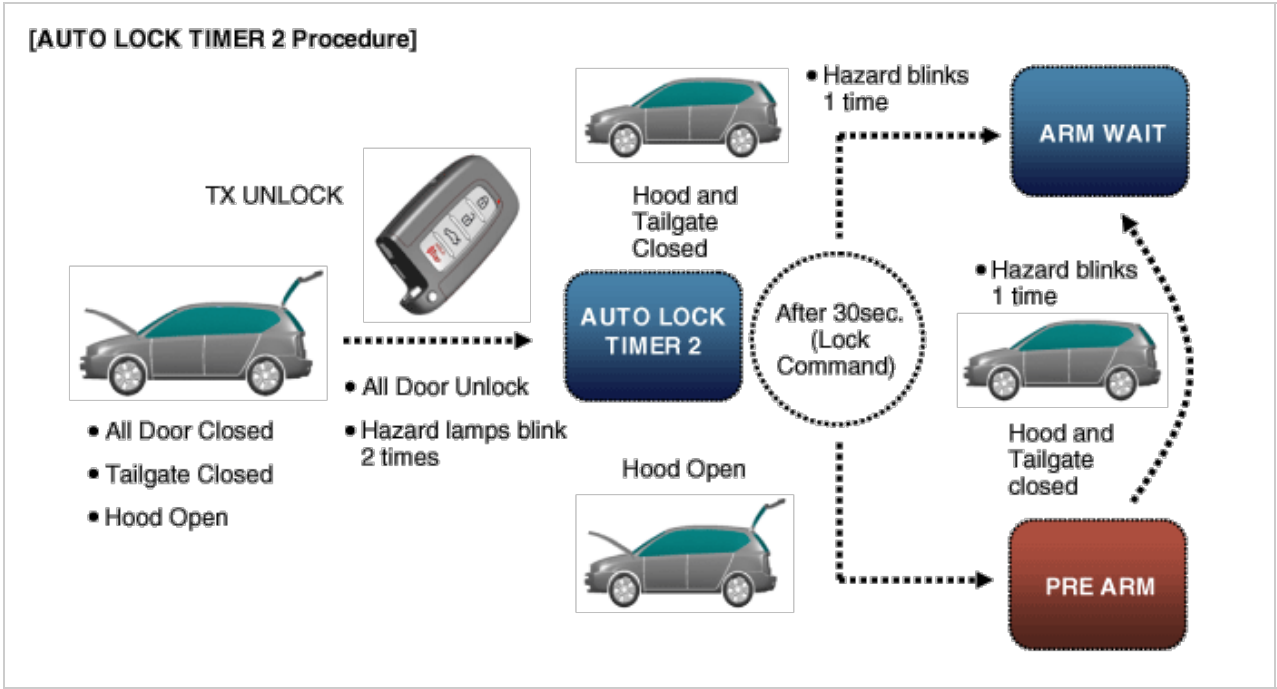
B/A State	Description
AUTO LOCK TIMER 1	1) In "AUTOLOCKTIMER1" state, timer "30sec."is running. If this timer expired, the auto lock command is generated "Lock command". 2) When "Lock command" operated, All Door changed lock and closed then B/A state changes "AUTOLOCKTIMER1" to "ARMWAIT" 3) In "AUTOLOCKTIMER1" state, Security Indicator keeps blinking. In "AUTOLOCKTIMER1" state, timer "30sec."is running. If this timer expired, the auto lock command is generated "Lock command". When "Lock command" operated, All Door changed lock and closed then B/A state changes "AUTOLOCKTIMER1" to "ARMWAIT

[AUTO LOCK TIMER 1 Procedure]

※ Remark : On Smart key system, it works the same way with passive unlock

B/A State	Description
AUTO LOCK TIMER 2	1) In "AUTOLOCKTIMER2" state, when timer "30sec."is running, if this timer expired, the auto lock command is generated "Lock command". 2) All doors are Locked, Hood is closed and Tailgate is closed when "Lock command" operated, then B/A state changes to"AUTOLOCKTIMER2" when "Lock Command" generated with Hood open. 3) When "Unlock command" operated on the condition of All Door closed and Hood open, B/A state changes to "AUTOLOCKTIMER2". 4) In "AUTOLOCKTIMER2" state, Security Indicator keeps blinking.

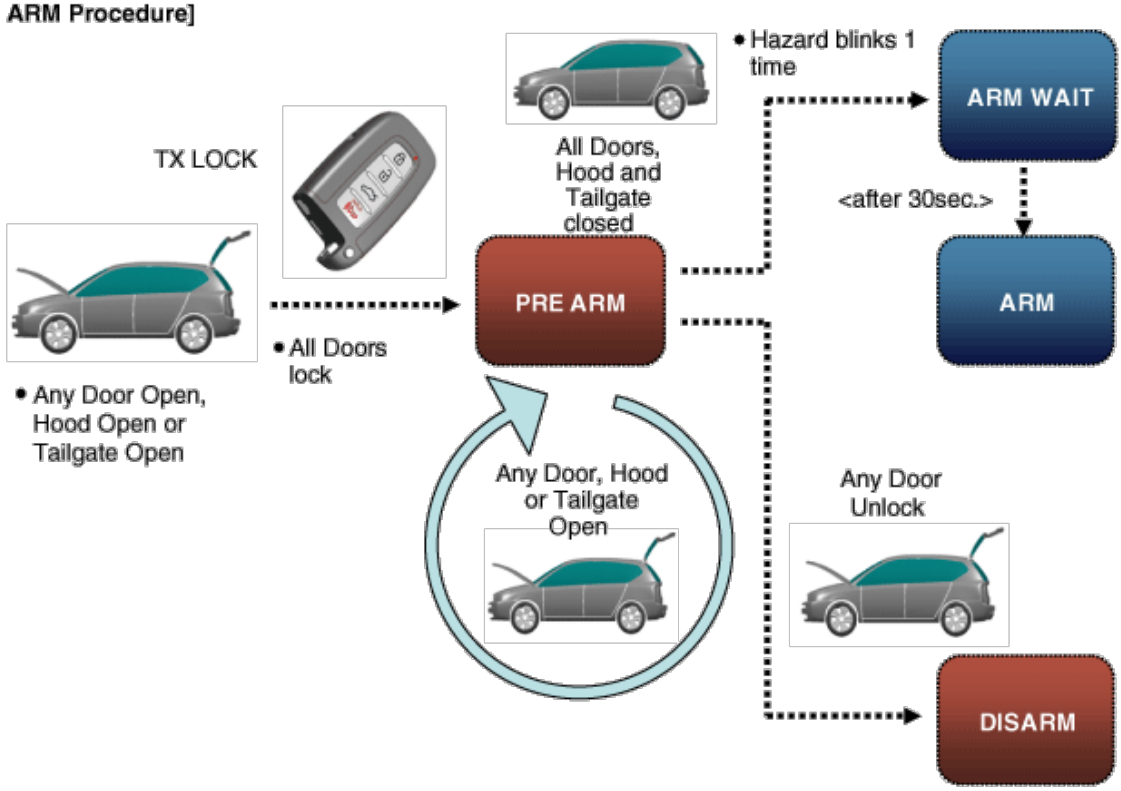
[AUTO LOCK TIMER 2 Procedure]



※ Remark : On Smart key system, it works the same way with passive unlock

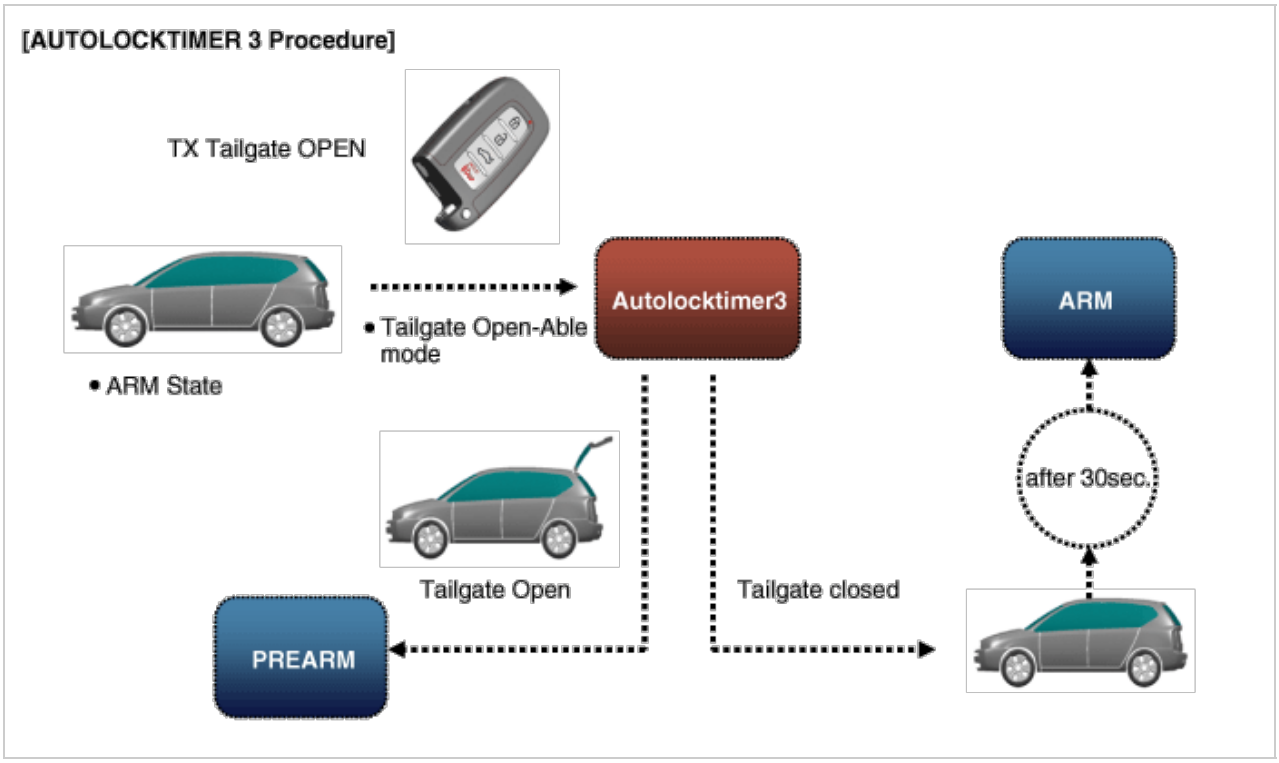
B/A State	Description
PRE ARM	1) The "PREARM" state is when user try to change to arm but pre-condition are not satisfied (door open, tailgate open, or hood open). 2) B/A state changes to "PREARM" when TX Lock command occurs with any door Open, Hood or Tailgate Open. 3) B/A state changes to "PREARM" when "30sec." timer expired in"AUTOLOCKTIMER2"with Hood or Tailgate Open 4) The "PREAMR" state changes to "ARM" when all doors closed, All doors locked and Hood and Tailgate closed. 5) The "PREAMR" state changes to "DISARM" when Any Door Unlock 6) In this state, Security indicator keeps blinking.

[RPE ARM Procedure]



B/A State	Description
RE ARM	1) In "REARM" state, if the vehicle intrusion is detected, flashing and sound is restarted, again and state transits to "ALARM" state. 2) B/A state changes to "REARM" after the timer "27sec." expires in "ALARM" state with All doors closed and lock. 3) Security Indicator keeps blinking.

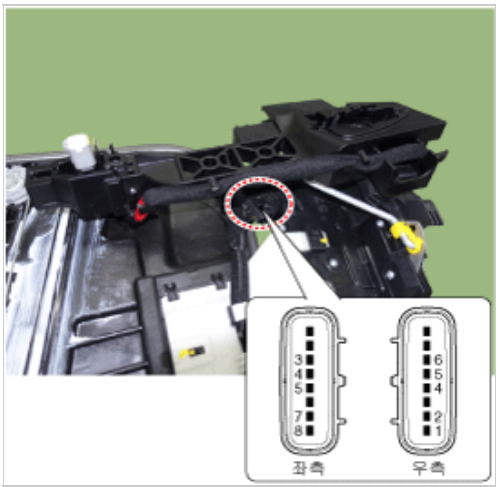
B/A State	Description
AUTOLOCK TIMER3	1) B/A state changes to "AUTOLockTIMER3", when TX-Tailgate command operated. 2) B/A state changes "AUTOLOCKTIMER3" to "ARMWAIT", when the "30sec." timer expires with all doors lock and closed. 3) B/A state changes "AUTOLOCKTIMER3" to "DISARM", when any door open. 4) In "AUTOLOCKTIMER3" state, timer "30sec." timer is running. If this timer expired, state transits to "PREARM" state with Tailgate Open. 5) In this state, Security indicator keeps blinking



- Inspection

Front Door Lock Module Inspection

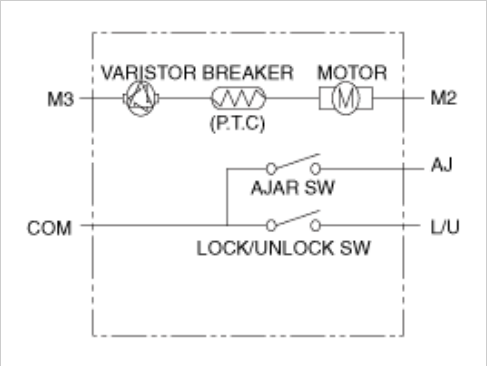
1. Remove the front door trim.
   (Refer to Body - "Front Door Trim")
2. Remove the front door module.
   (Refer to Body - "Front Door Module")
3. Disconnect the connectors from the actuator.



4. Check actuator operation by connecting power and ground according to the table.

Pin	Driver	Panssenger
1	-	M2
2	-	M3
3	COM	-
4	Lock/Unlock switch	AJAR
5	AJAR	Lock/Unlock switch
6	-	COM

7	M3	-
8	M2	-



OPERATION / TERMINAL	C/LOCK	C/UNLOCK
	LH	LH
8	-	+
7	+	-
3 & 4	ON → OFF	OFF → ON
3 & 5	DR OPEN & Half Latching, ON Full Latching, OFF	

OPERATION / TERMINAL	C/LOCK	C/UNLOCK
	RH	RH
1	+	-
2	-	+
6 & 5	ON → OFF	OFF → ON
6 & 4	DR OPEN & Half Latching, ON Full Latching, OFF	

Rear Door Lock Module Inspection

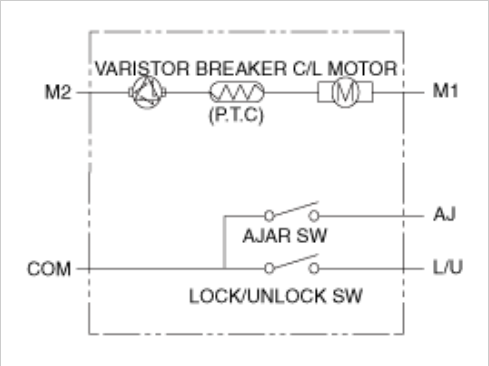
1. Remove the rear door trim.
   (Refer to Body - "Rear Door Trim")
2. Remove the rear door module.
   (Refer to Body - "Rear Door Module")
3. Disconnect the connectors from the actuator.

4. Check actuator operation by connecting power and ground according to the table.

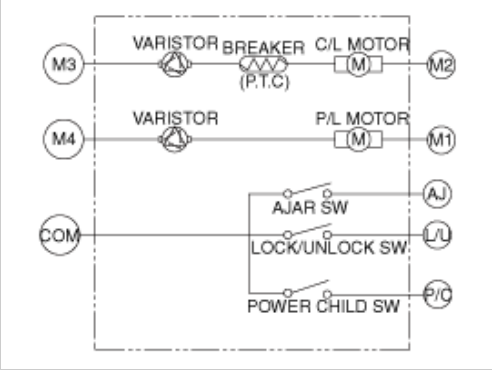
Pin	Driver		Panssenger	
	Central Lock	Power Child Lock	Central Lock	Power Child Lock
1	-	Power child switch	M1	M2

2	COM	COM	M2	M3
3	Lock/Unlock switch	Lock/Unlock switch	-	M1
4	AJAR	AJAR	-	M4
5	-	M4	AJAR	AJAR
6	-	M1	Lock/Unlock switch	Lock/Unlock switch
7	M2	M3	COM	COM
8	M1	M2	-	Power child switch

[Central Lock]



[Power Child Lock]



[Central Lock]

OPERATION / TERMINAL	C/LOCK	C/UNLOCK
	LH	LH
8	-	+
7	+	-
2 & 3	ON → OFF	OFF → ON
2 & 4	DR OPEN & Half Latching, ON Full Latching, OFF	

OPERATION / TERMINAL	C/LOCK	C/UNLOCK
	RH	RH
1	+	-
2	-	+
7 & 6	ON → OFF	OFF → ON
7 & 5	DR OPEN & Half Latching, ON Full Latching, OFF	

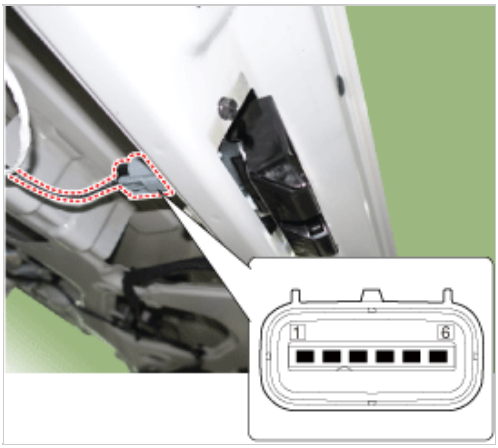
[Power Child Lock]

OPERATION / TERMINAL	C/LOCK	C/UNLOCK	CHILD /LOCK	CHILD /UNLOCK
	LH	LH	LH	LH
8	-	+		
7	+	-		
6			-	+
5			+	-
2 & 3	ON → OFF	OFF → ON		
2 & 4	DR OPEN & Half Latching, ON Full Latching, OFF			
2 & 1			ON → OFF	OFF → ON

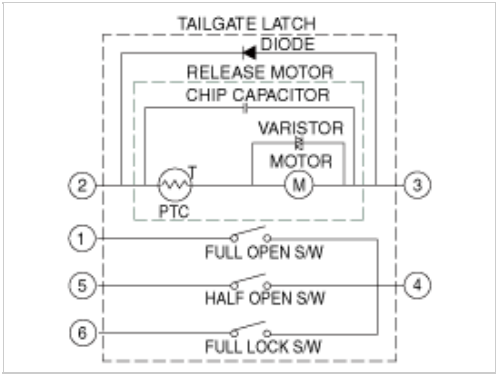
OPERATION / TERMINAL	C/LOCK	C/UNLOCK	CHILD /LOCK	CHILD /UNLOCK
	RH	RH	RH	RH
1	+	-		
2	-	+		
3			+	-
4			-	+
7 & 6	ON → OFF	OFF → ON		
7 & 5	DR OPEN & Half Latching, ON Full Latching, OFF			
7 & 8			ON → OFF	OFF → ON

Tailgate Lock Module Inspection

1. Remove the tailgate trim.
   (Refer to Body - "Tailgate Trim")
2. Disconnect the 4P connector from the actuator.



3. Check actuator operation by connecting power and ground according to the table.



	MOTOR		SWITCH		
	2	3	1	5	6
FULL LOCK			OFF	OFF	OFF
HALF LOCK			ON	OFF	ON
FULL OPEN	+	-	ON	ON	ON

Hood Switch

1. Disconnect the connector and bolts from the hood switch.

2. Check for continuity between the terminals and ground according to the table.

Position \ Terminal	1	2
Hood Open(Free)	○	○
Hood Close(Push)		

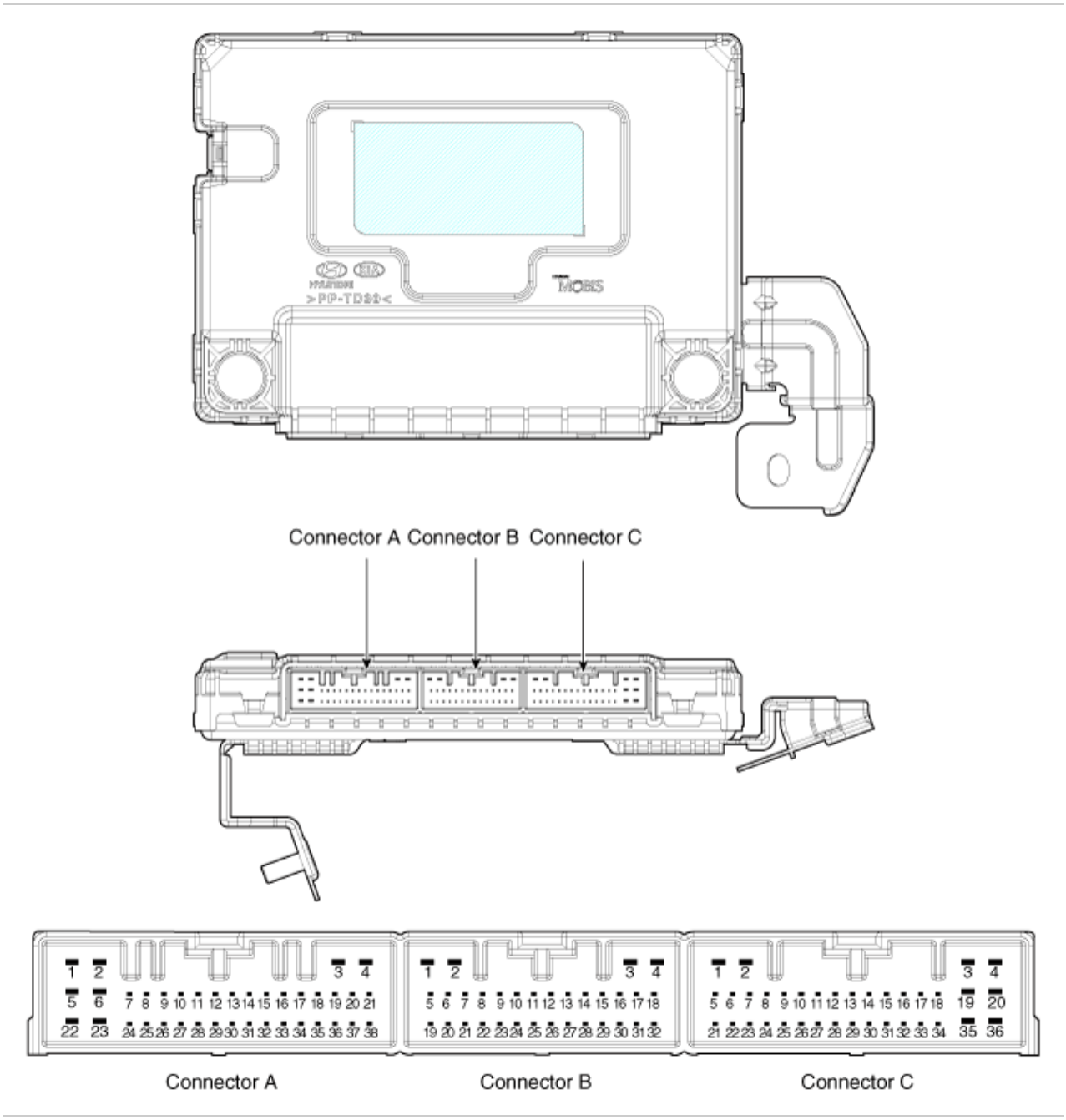
Body Electrical System

- Specifications

Items	Specifications
Rated voltage	DC -40V
Operating voltage	DC -40V
Operating temperature	-40°C to 85°C (-22°F to 185°F)
parastic current	4.0 mA (2.5 mA increase for welcome light operation / 1.5 mA increase for security indicator operation)

Body Electrical System

- Components (1)

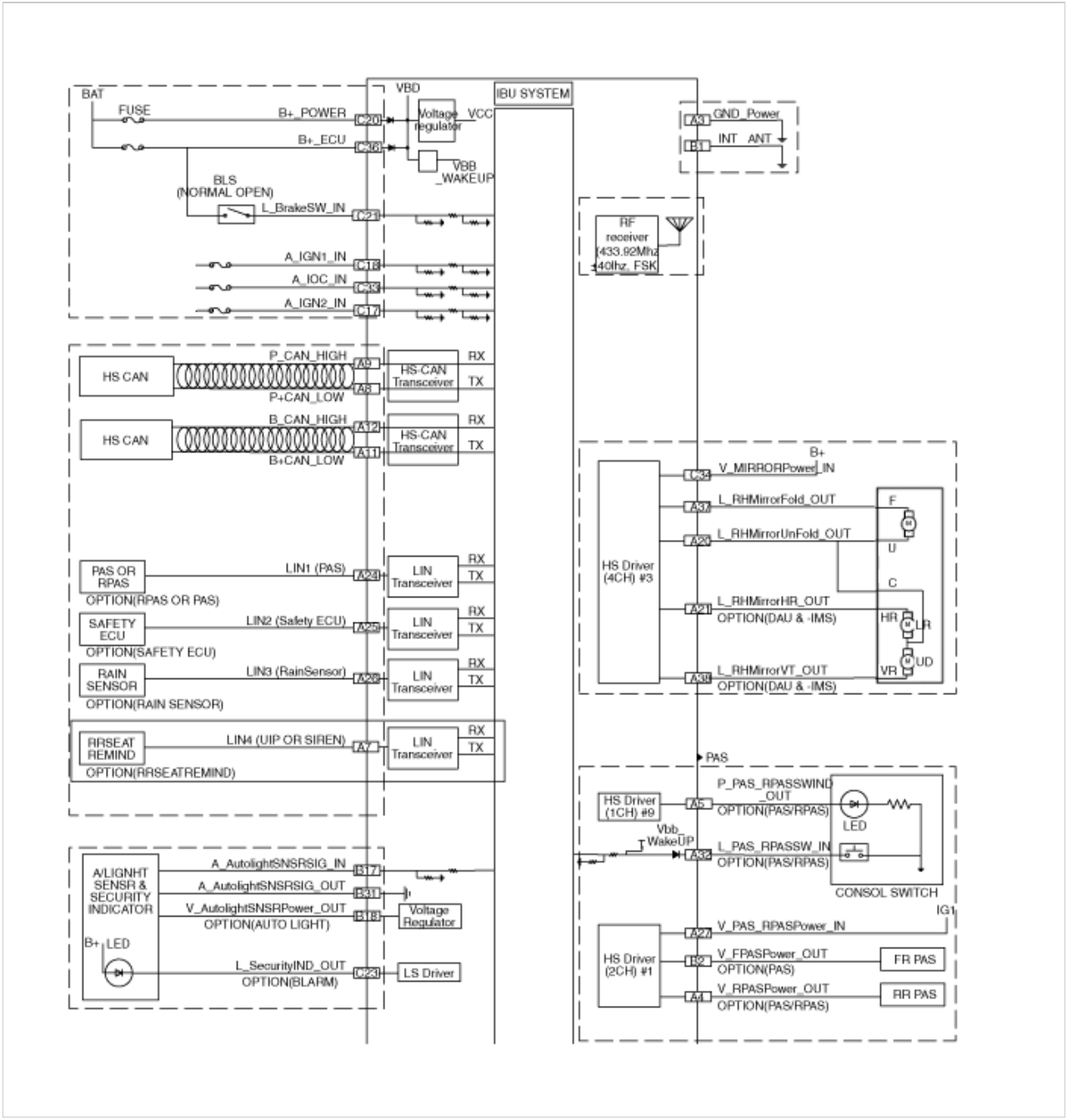


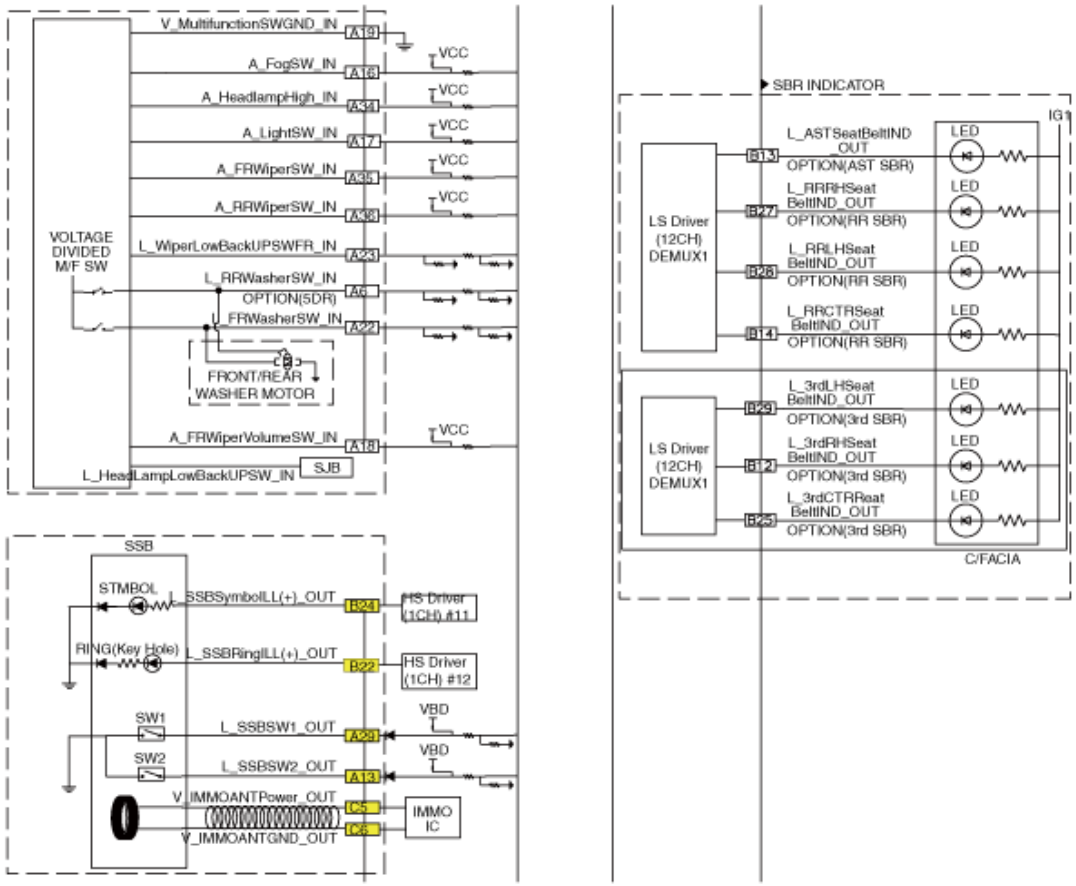
Connector Pin Information

No	Connector A	Connector B	Connector C
1	-	GND_ECU	Front wiper relay (Low)_output
2	-	PDW-F power_output	ESCL (+)_output
3	GND_Power	ESCL (-)_output	Start relay_output
4	PDW-R_Power_Output	Front wiper high relay_output	IGN1 relay_output
5	-	PDW-R WIND_output	Immobilizer antenna power_output
6	Rear washer switch_input	-	Immobilizer antenna ground_output
7	LIN4 (Rear seat remind)	-	-
8	P_CAN (Low)	Rear view switch_input	Interior1 antenna (+)_output
9	P_CAN (High)	-	Driver outside handle antenna(+)_output
10	-	Wheel speed sensor_input	-
11	B_CAN (Low)	-	Passenger outside handle antenna(+)_output
12	B_CAN (High)	3rd line sheet belt indicator RH_output	-

13	SSB switch_input	Passenger seat belt indicator_output	Trunk interior antenna3(+)_output
14	Driver handle antenna switch_input	Rear center seat belt indicator_output	Immobilizer K-Line
15	P position_input (AT) Clutch lock switch_input (MT)	-	Bumper antenna (+)_output
16	Fog switch_input	LF searching_output	Interior antenna2(+)_output
17	Light switch_input	Auto light sensor signal_input	IGN2_input
18	Front wiper INT volume switch_input	Auto light sensor power_output	IGN1_input
19	Multifunction switch_input	ATM solenoid_output	IGN2 relay_output
20	Right side mirror unfolding switch_oupout	Puddle pocket lamp_output	Battery_power
21	Right side mirror heater_output	-	Brake switch_input
22	Front washer switch_input	SSB ring illumination_output	Start feedback_input
23	Front wiper low switch_Input	piezo buzzer_output	Security indicator_output
24	LIN1 (PDW)	SSB symbol illumination_output	Interior1 (-)_output
25	LIN2 (Safety ECU)	-	Driver outside handle antenna (-)_output
26	LIN3 (Rain sensor)	Wiper power relay_output	-
27	PDW/PDW-R power_input	Rear seat belt indicator RH_output	Passenger outside handle antenna (-)_output
28	PDW_input	Rear seat belt indicator LH_output	ESCL COM
29	SSB switch1_input	3rd line sheet belt indicator LH_output	Trunk Interior antenna3(-)_output
30	ESCL unlock_input	Rear wiper relay_output	ESCL Enable_output
31	Passenger outside handle switch_input	Auto light sensor ground_output	Bumper antenna (-)_output
32	PDW switch_input	Wiper parking switch_input	Interior antenna2 (-)_output
33	Sun roof Status_input		
34	Head lamp switch_input		
35	Front wiper switch_input		
36	Rear wiper switch_input		
37	Mirror folding RH_output		
38	Mirror RH VT_output		

- Circuit Diagram


BAT
FUSE
B+_POWER
B+_ECU
C20
C26
VBD
Voltage regulator
VCC
VBB _WAKEUP
IBU SYSTEM
A31
GND_Power
B1
INT ANT
BLS (NORMAL OPEN)
L_BrakeSW_IN
C21
RF receiver (433.92Mhz 40Ihz_FSK
A_IGN1_IN
C18
A_IOC_IN
C23
A_IGN2_IN
C17
HS CAN
P_CAN_HIGH
A9
P+CAN_LOW
A8
HS-CAN Transceiver
RX
TX
HS CAN
B_CAN_HIGH
A12
B+CAN_LOW
A11
HS-CAN Transceiver
RX
TX
B+
HS Driver (4CH) #3
C34
V_MIRRORPower_IN
A37
L_RHMirrorFold_OUT
A20
L_RHMirrorUnFold_OUT
A21
L_RHMirrorHR_OUT
OPTION(DAU & -IMS)
A39
L_RHMirrorVT_OUT
OPTION(DAU & -IMS)
F
U
C
HR
LR
VR
UD
PAS OR RPAS
OPTION(RPAS OR PAS)
LIN1 (PAS)
A24
LIN Transceiver
RX
TX
SAFETY ECU
OPTION(SAFETY ECU)
LIN2 (Safety ECU)
A25
LIN Transceiver
RX
TX
RAIN SENSOR
OPTION(RAIN SENSOR)
LIN3 (RainSensor)
A26
LIN Transceiver
RX
TX
RRSEAT REMIND
OPTION(RRSEATREMIND)
LIN4 (UIP OR SIREN)
A7
LIN Transceiver
RX
TX
PAS
HS Driver (1CH) #9
A5
P_PAS_RPASSWIND_OUT
OPTION(PAS/RPAS)
LED
Vbb_WakeUP
A32
L_PAS_RPASSW_IN
OPTION(PAS/RPAS)
CONSOL SWITCH
A/LIGNHT SENSR & SECURITY INDICATOR
B+
LED
A_AutolightSNSRSIG_IN
B17
A_AutolightSNSRSIG_OUT
B31
V_AutolightSNSRPower_OUT
B18
OPTION(AUTO LIGHT)
Voltage Regulator
L_SecurityIND_OUT
B23
OPTION(BLARM)
LS Driver
IG1
A27
V_PAS_RPASPower_IN
HS Driver (2CH) #1
B2
V_FPASPower_OUT
OPTION(PAS)
FR PAS
A4
V_RPASPower_OUT
OPTION(PAS/RPAS)
RR PAS



- Description

Body Control Module Controls The Followings

- Wiper & Washer Control
- Defroster Control
- Driving Control
- Tailgate Control
- Window Control
- Interior Control
- Exterior Control
- Panic alarm Control
- MTS
- Flasher output Control
- Door lock/unlock Control
- Burglar alarm Control
- Remote start Control
- UMS(User Mode Setting) Control
- Gateway/ Diagnosis

Integrated Body Control Unit (IBU)

Integrated body control unit has integrated several functions including body control module (IBU), smart key unit (SMK), and tire pressure monitoring system (TPMS).

1. Body Control Module (IBU) Functions

Burglar Alarm	Trunk Burglar Alarm	Issues an alarm depending on the trunk operation.
	Panic Alarm	Generates warning sound and displays flasher lamp (horn & flasher) depending on the panic signal.
	Security Lamp Control	Controls security lamp in vehicle alert status.
External Lamp	Tail Lamp	Turns on / off the tail lamp automatically. It also turns off the tail lamp automatically when the driver forgot to turn off the lamp switch.
	Auto Light	Turns on/off the tail lamp and head lamp automatically depending on whether it is day or night when the head lamp switch is placed at Auto.
	Welcome Light	The welcome light function turns on the head lamp and tail lamp for 15 seconds when an unlock signal is detected while vehicle door is locked.
	Escort Function	Turns on the escort lamp when the power is turned off while the head lamp is on. – It turns on the head lamp and maintains the state for 20 minutes if ignition is turned off while the head lamp is on. – The head lamp remains on only for 30 seconds when the driver seat door is opened and closed during the 20-minute period. – The head lamp turns off when remote control lock button is pressed twice while the head lamp is on.
	Head Lamp (Low Beam / High Beam)	Controls high beam / low beam depending on the head lamp switch (multi-functional switch).
	Daytime Driving Light Control	Controls the daytime driving light lamp depending on the conditions at the time of vehicle start.
Internal Lamp	Foot Lamp	Turns on/off the foot lamp depending on the power conditions and whether the shift lever is at the P position.
	Engine Start Maintenance Button Lamp	Turns on/off the SSB lamp depending on vehicle power conditions, door open / closed status, and alert mode.
	Room Lamp	Turns on/off the interior lamp depending on vehicle power conditions and door open / closed status.
	Mood Lamp	Turns on/off the mood lamp depending on user settings.
Front / Rear Parking Assist	PAS Display	Receives a signal from parking assist sensor through LIN communication and displays it on the instrument cluster.
	PAS Warning	Detects obstacles in front and rear sides using the parking assist sensor (PAS sensor) in the case of gear input (R or D) and issues a warning if there is an obstacle.
Warning	Seat Belt Reminder and Indicator Lamp	Issues a warning if the seat belt is not fastened, and prevents pattern activation if the vehicle is driven while the seat belt is not fastened.
	Key Reminder Warning	Issues a warning if the driver seat door is open while ACC is on.
	Parking Brake Warning	Generates a warning sound if vehicle speed exceeds 5 km/h while IGN is on and parking brake is on.
	Sunroof Open Warning	Issues a warning if the key is removed and the driver leaves the vehicle while the sunroof is open.
Wiper and Washer	Wiper (Low / High / Mist / Auto)	IBU receives wiper switch signal via B-CAN and sends the data to wiper motor (embedded) via LIN communication.
	Front Washer	IBU sends the washer switch signal to front washer motor.

2. Smart Key Unit (SMK) Functions

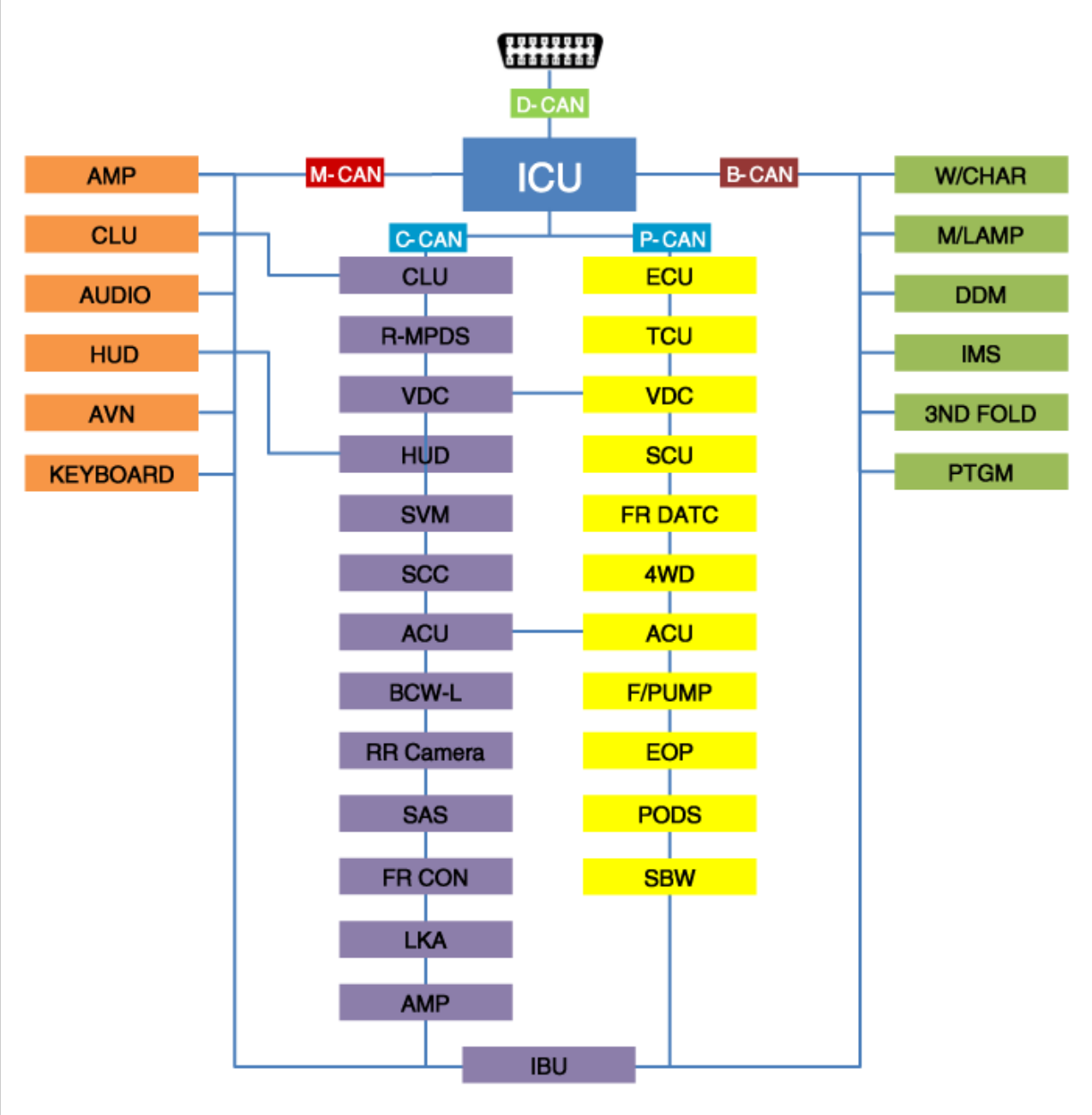
SMK	Door Lock and Unlock	Locks/Unlocks the door based on the door unlock signal and the signal from push buttons on the driver seat / passenger seat outside handles.
	SMK Welcome Light	Controls door mirror and puddle lamp after smart key authentication when the driver with smart key approaches the vehicle.
	Smart Trunk	Opens the trunk if the driver with valid smart key stays in front of the rear bumper (within LF antenna range) for 3 seconds or more.
SMK Warning	Key Reminder 1	When the driver attempts to lock the door, it checks if there is a smart key inside the vehicle and unlocks the door if there is one.
	Key Reminder 2	Checks the door lock status for 0.5 seconds after the vehicle door is closed and unlocks the door and generates a warning sound using the external buzzer if the door is locked.
	Door Lock Warning 1	Generates a warning sound with the external buzzer if the driver tries to leave the vehicle while ACC or IGN is on.
	Door Lock Warning 2	Generates a warning sound with the external buzzer if the driver tries to lock the door and leave the vehicle while one or more doors are open.
	Door Lock Warning 3	

		Searches for a smart key inside the vehicle when the driver tries to lock the door, and issues a warning and does not lock the door if there is a smart key inside.
	Key Out Lamp Warning	If the vehicle moves at 3 km/h or less while ACC or IGN is on and the door is open, it searches for the smart key every 3 seconds and blinks the warning lamp if there is no smart key.
SMK RKE (Remote Keyless Entry)	Door Lock / Unlock	Locks/Unlocks the door based on the door unlock signal and the signal from push buttons on the driver seat / passenger seat outside handles.
	Panic	Performs vehicle panic and panic stop functions based on the panic button signal.
	Window Open	Opens/Closes vehicle window based on the smart key signal.
Engine Start		Start Stop Button (SSB), Immobilizer, Start Relay Power Control, SSB Lamp Control

3. Tire Pressure Monitoring System (TPMS) Functions

   Tire pressure monitoring system continuously monitors pressure and temperature inside the tire in order to warn the driver of the changes in tire pressure that may have influence on vehicle driving conditions. TPMS control module analyzes the data from the WE (Wheel Electronic) sensor attached inside each wheel and determines the tire conditions and generates a signal that is necessary for warning lamp control.

Communication Network Diagram

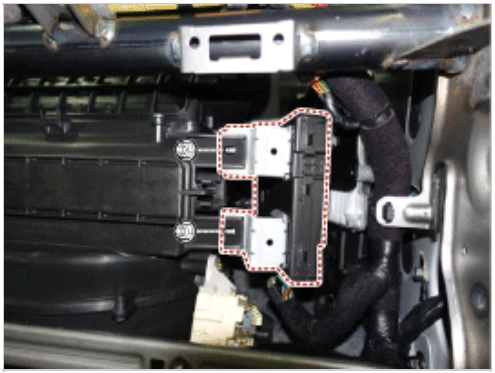


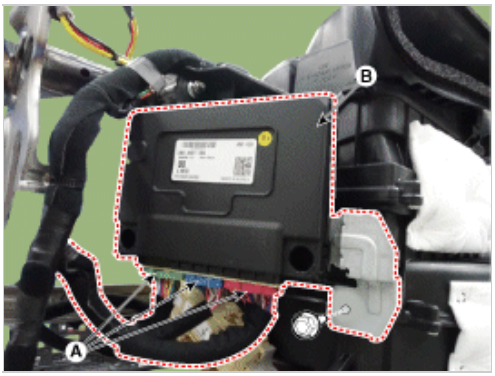
Abbreviation	Explanation

IBU	Interated Body Control Unit
DDM	Driver Door Module
PTGM	Power Tail Gate Module
ICU	Interated Control Unit
ECU	Engine Control Unit
CLU	Cluster
MDPS	Moter Driven Power Steering
SVM	Sorround View Monitor
ACU	Airbag Control Unit
VDC	Vehicle Dynamic Control
SCC	Smart Cruise Control
LKA	Lane Keeping Assist
BCW	Blind-Spot Collision Warning
SAS	Steering Angle Sensor
HUD	Head up Display
TCU	Transmission Control Unit
FR DATC	Dual Automatic Temp Control
4WD	Four Wheel Drive
F/PUMP	Fuel Pump Control Module
POCS	Passenger Occupant Classification System
IMS	Integrated Memory System
AMP	Amplifier
AVN	Head Unit (Audio / AVN)
HUD	Head Up Display
RR CAMERA	Rrar View Camera
FR CON	Front Console Switch
EOP	Electric Oil Pump
SBW	Shift BY Wire
W/CHAR	Wireless Power Chager
FR M/LP	Front Mood Lamp
3ND FOLD	3ND Seat Folding Control Unit
AUDIO	Audio unit
KEY BOARD	Center Fascia Keyboard

- Removal

1. Disconnect the negative (-) battery terminal.
2. Remove the glove box housing.
   (Refer to Body - "Glove Box")
3. Disconnect the IBU connector (A).
4. Remove the IBU (B) after loosening mounting bolt and nuts.



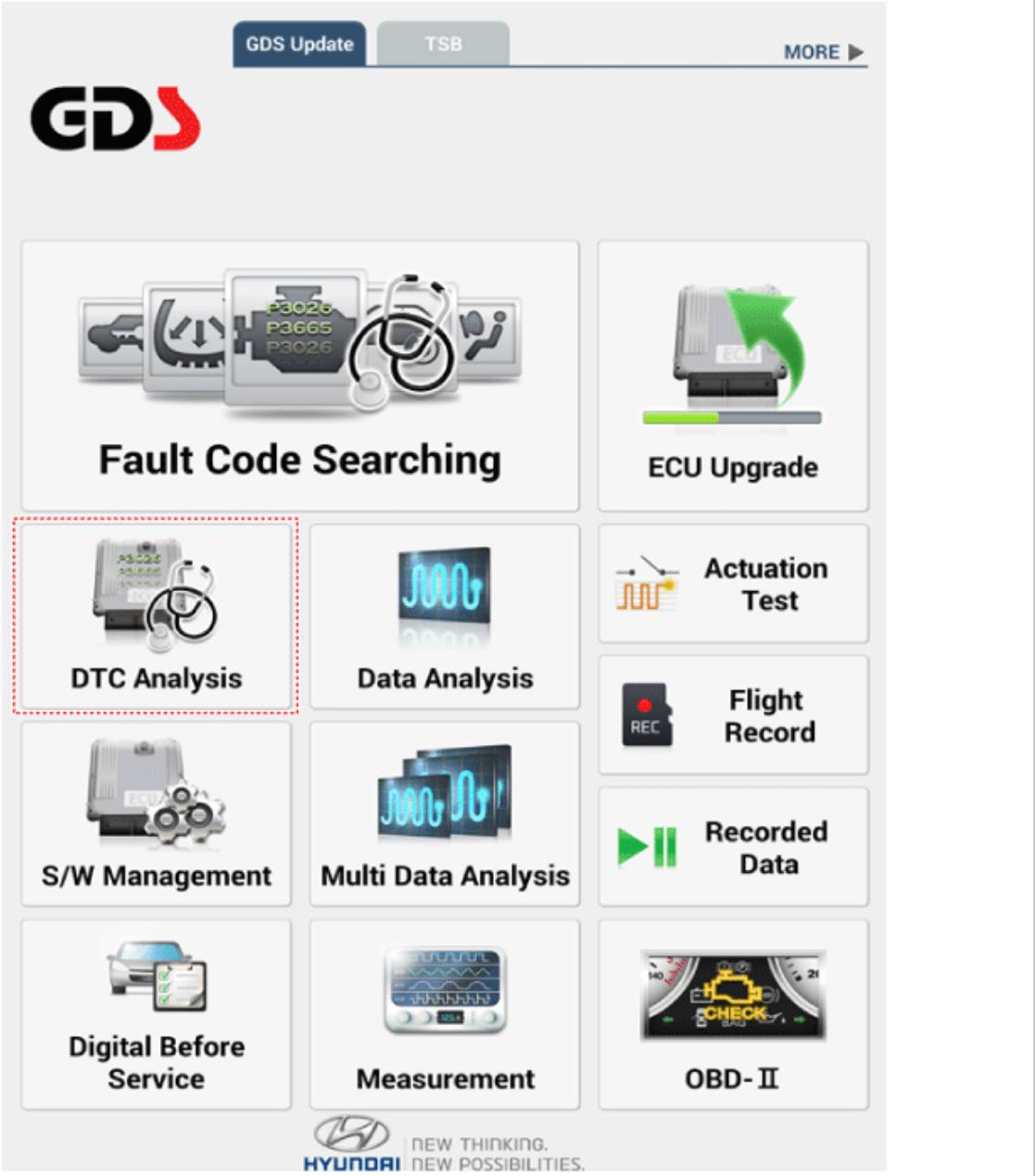


- Installation

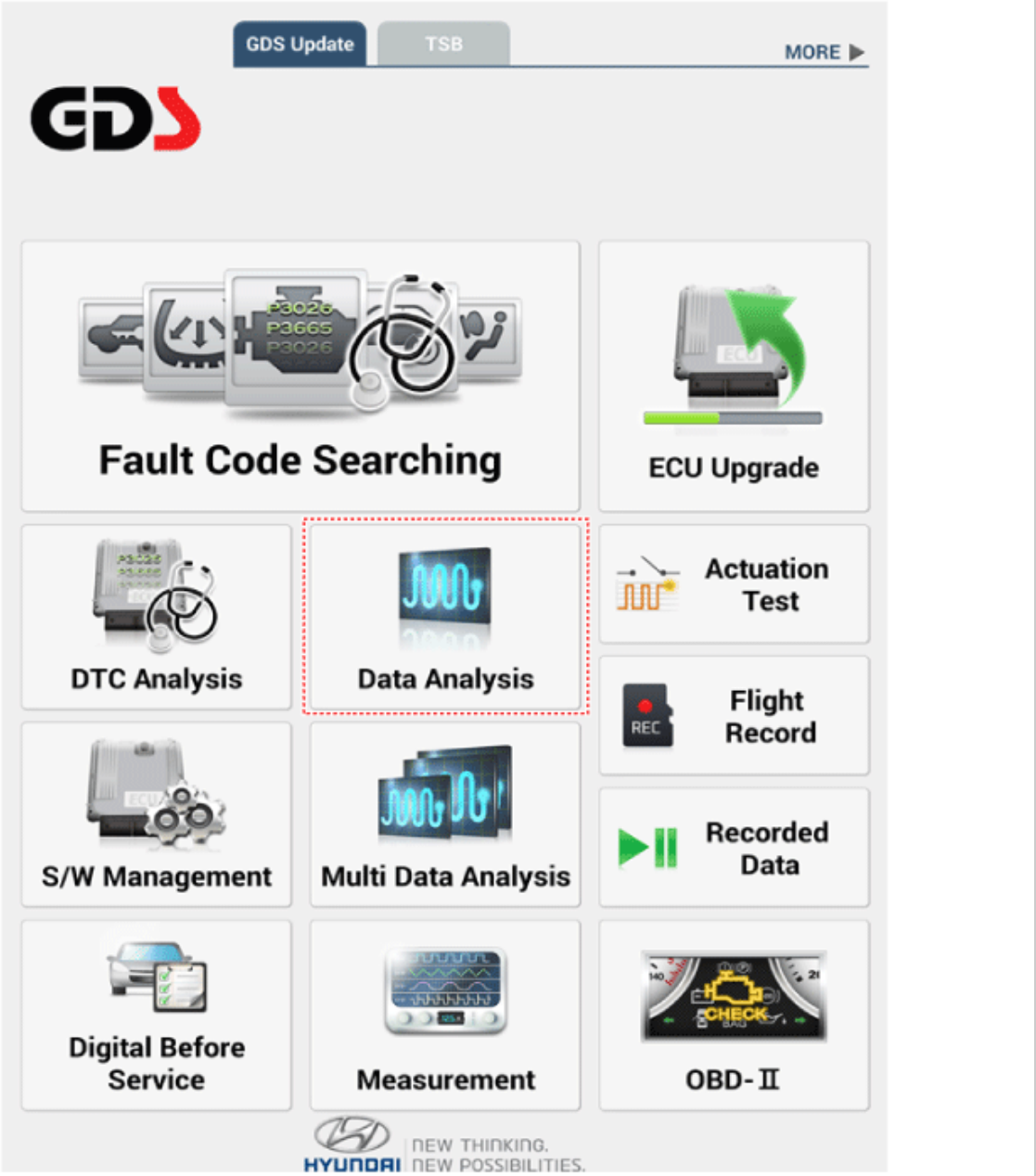
1. Install the integrated body control module.
2. Connect the integrated body control module.
3. Install the glove box.
4. Connect the negative (-) battery terminal.

- BCM Diagnosis With Diagnostic tool

1. In the body electrical system, failure can be quickly diagnosed by using the vehicle diagnostic system (Diagnostic tool).
   (1) Fault Code Searching : Checking failure and code number (DTC)
   (2) Data Analysis : Checking the system input/output data state
   (3) Actuation test : Checking the system operation condition
   (4) S/W Management : Controlling other features including system option setting and zero point adjustment
2. If diagnose the vehicle by Diagnostic tool, select "DTC Analysis" and "Vehicle".

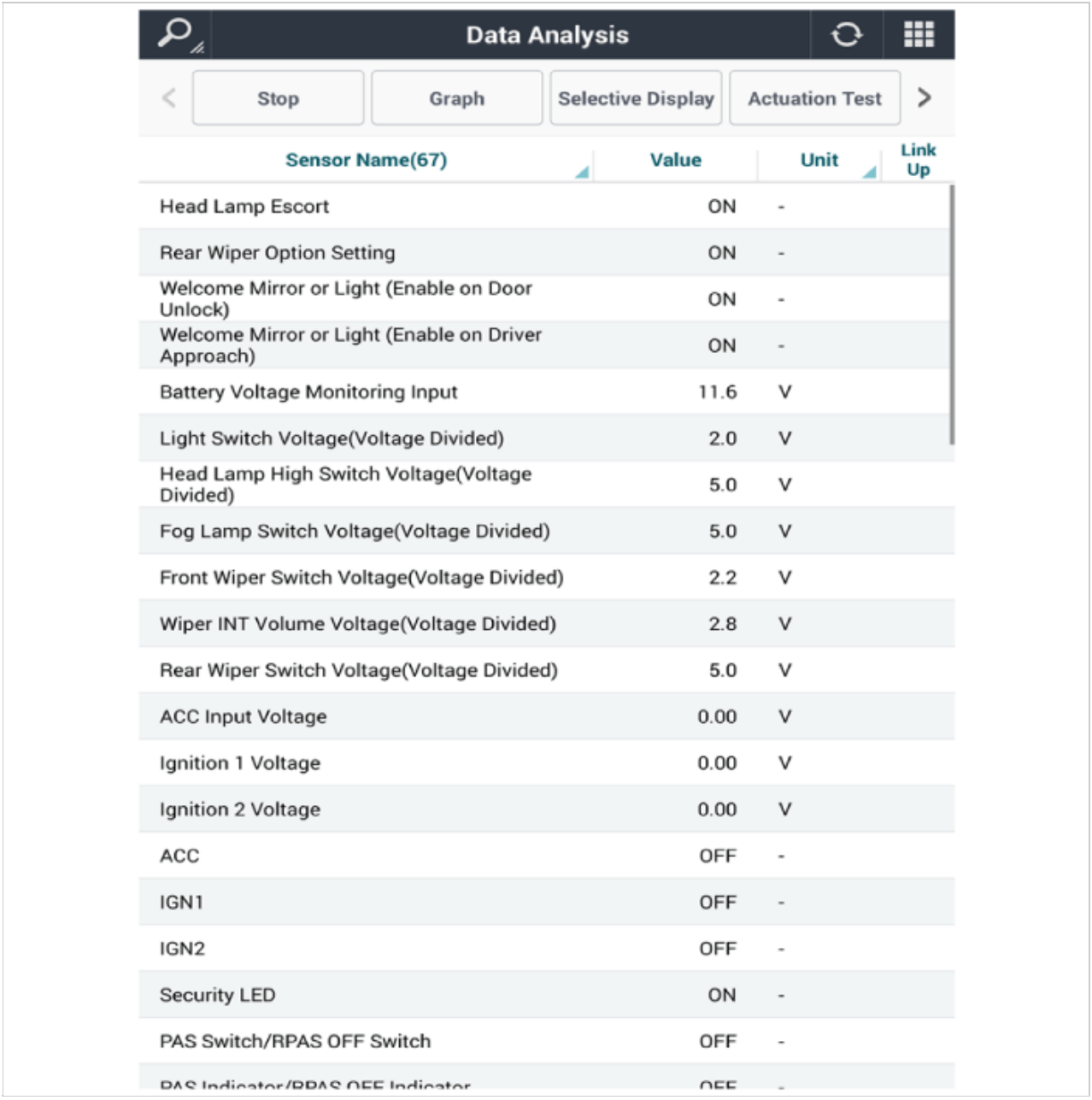


3. If check current status, select the "Data Analysis" and "Car model".



4. Select the 'IBU_BCM' to search the current state of the input/output data.

Vehicle Selection
PREV
AUTO VIN
RESET
SANTAFE(SM)
SANTAMO(M2)
D 2.2 TCI-R
System Selection
ENGINE
A / T
ABS/ESP
FCA
AIRBAG
AIRCON
4WD
EPS
RVM
SVMS
PA
BCW
FR_CMR
AFLS
AHLS
AVN
CLU
DDM
80km/h
HUD
IBU-BCM
IBU-IMMO
IBU-SMK
IBU-TPMS
PSM
System
IBU-BCM
OK


Data Analysis
Stop
Graph
Selective Display
Actuation Test
Sensor Name(67)
Value
Unit
Link Up
Head Lamp Escort ON -
Rear Wiper Option Setting ON -
Welcome Mirror or Light (Enable on Door Unlock) ON -
Welcome Mirror or Light (Enable on Driver Approach) ON -
Battery Voltage Monitoring Input 11.6 V
Light Switch Voltage(Voltage Divided) 2.0 V
Head Lamp High Switch Voltage(Voltage Divided) 5.0 V
Fog Lamp Switch Voltage(Voltage Divided) 5.0 V
Front Wiper Switch Voltage(Voltage Divided) 2.2 V
Wiper INT Volume Voltage(Voltage Divided) 2.8 V
Rear Wiper Switch Voltage(Voltage Divided) 5.0 V
ACC Input Voltage 0.00 V
Ignition 1 Voltage 0.00 V
Ignition 2 Voltage 0.00 V
ACC OFF -
IGN1 OFF -
IGN2 OFF -
Security LED ON -
PAS Switch/RPAS OFF Switch OFF -

- Specifications

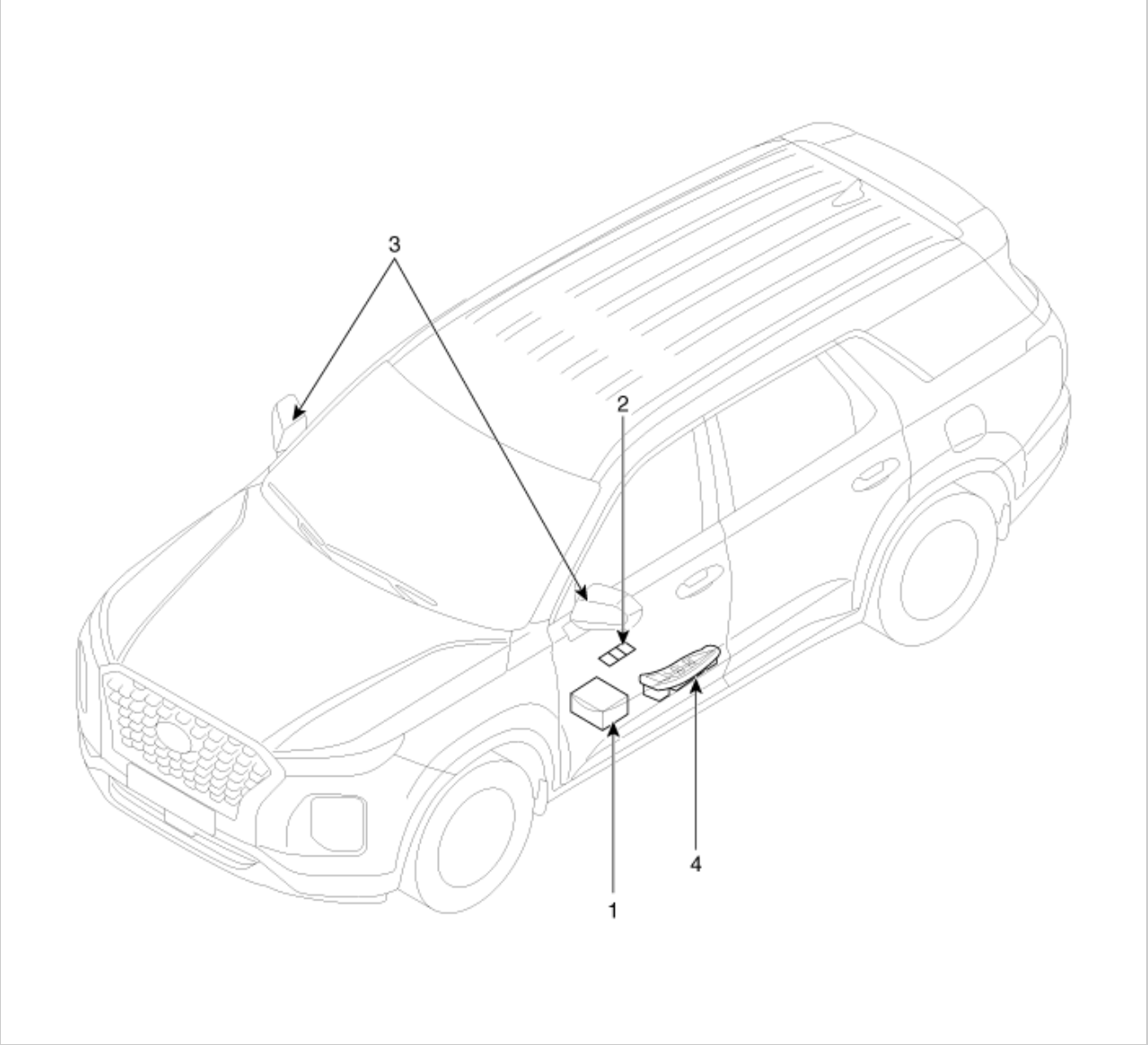
Memory Power Seat Unit

Item	Specification
Rating voltage	DC 12V
Operation voltage	DC 9V - 16V
Operation temperaure	-30°C to 75°C
parastic current	Max. 1 mA

Memory Power Seat Switch

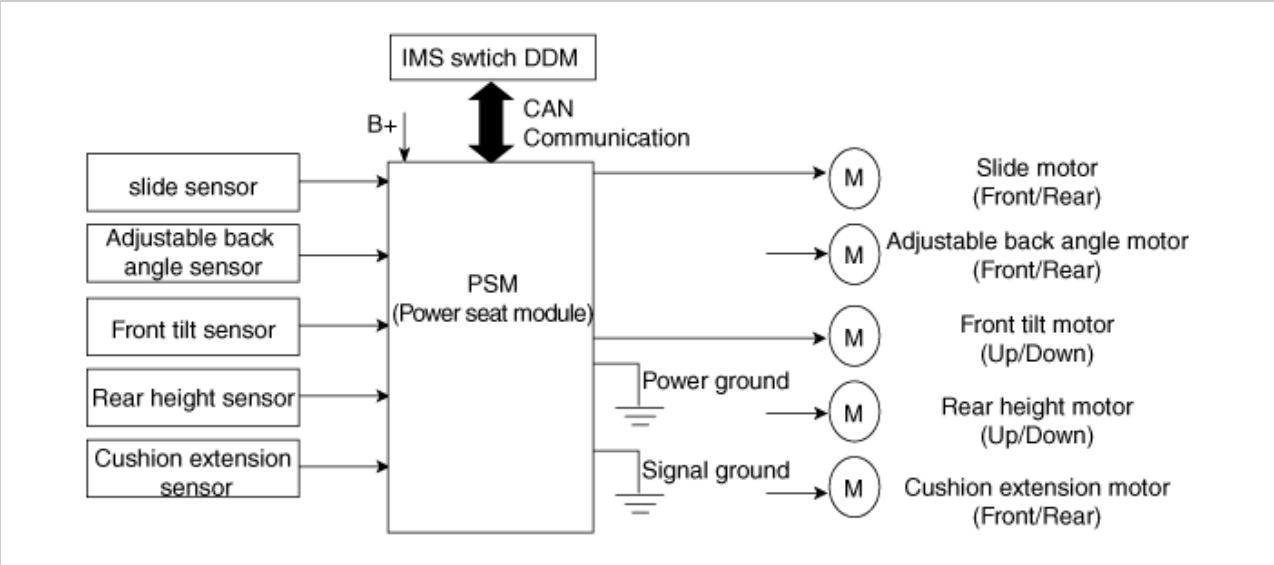
Item	Specification
Rating voltage	DC12V
Type	Soft Feeling Tact type
category temperature range	-30°C to 80°C

- Component Location



1. Seat Memory Unit (IMS)
2. IMS control switch
3. Outside mirror
4. IMS mirror control (Driver power window switch)

- Circuit Diagram



- Description

The optimal seat position set by the driver is memorized into the power seat unit by using IMS switch. In case of the position change, the seat can restore its preset position by IMS switch.

It has safety functions of restoring process prohibition during driving and of emergency stop of the linked motion.

The main functions are as follows.

1. Manual operation : Motor control with the seat manual switch.
   (1) The position of the seat is changed by operating the motor when the signal is input with manual switch for the seat (Slide, recline, front tilt, rear height adjusting cushion extension)

2. Memory function : Available for memorizing/reproducing the data for two persons with IMS switch.
   (1) The memorized motion for the optimal seat position set by the driver based on the CAN data with 『DDM → IMS module』 with IMS switch.
   (2) Reproduction by the CAN data received from DDM during IMS switch controlling.

3. Motion linked to getting on/off
   (1) This function links motion depending on the state of ON/OFF the engine.
   (2) Use of IMS CAN data communcation.
   (3) Condition for operating getting on : When the electric power is in ACC.

- Operation

Reproducing Motion

1. If the reproduction CAN data is received from DDM, the buzzer is issued one time and the seat is automatically moved to the memorized position.
2. The CAN data not memorized does not perform reproduction function.
3. If CAN data is newly received during previous data reproduction, the final data takes precedence.
4. If the reproduction CAN data is received by pressing button 1 or 2 during reproduction, the seat stops the reproduction process.
5. If the memorized CAN data is received by pressing SET button during reproduction, the seat stops the reproduction process.

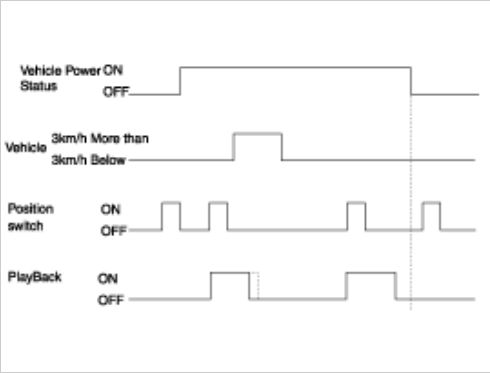
> **NOTICE**
> Press the SET button once more to store the position of stop.

6. Automatically stop when remart switch is OFF during reproduction.
7. Do not operate the motor when the difference between the memorized position for reproduction and current position is less than 4 pulses.

Conditions for Prohibiting the Reproduction

In case any of the following conditions is met, the reproduction is prohibited and the controlling stops during reproduction.

1. IGN2 OFF (Excluding within 30 seconds after door opening or closing.)
2. Higher than 3km/h of vehicle speed
3. When the switch is controlled manually
4. Operation time chart

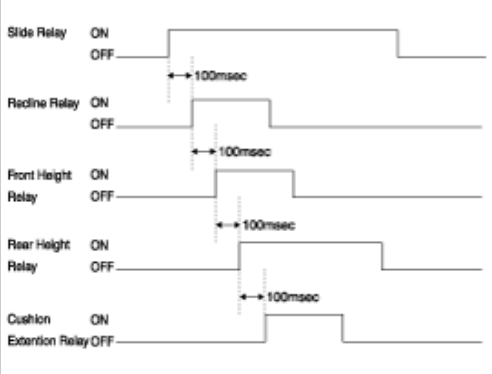


Decision on the Operation Priority

1. For automatic control, the motor operation shall be delayed by 100±10m sec to prevent the overlapping of inrush circuit and in this case the priority shall be given as follows.

   Slide ＞ Backrest adjustment ＞Front height adjustment ＞Rear height adjustment > Cushion extension adjustment

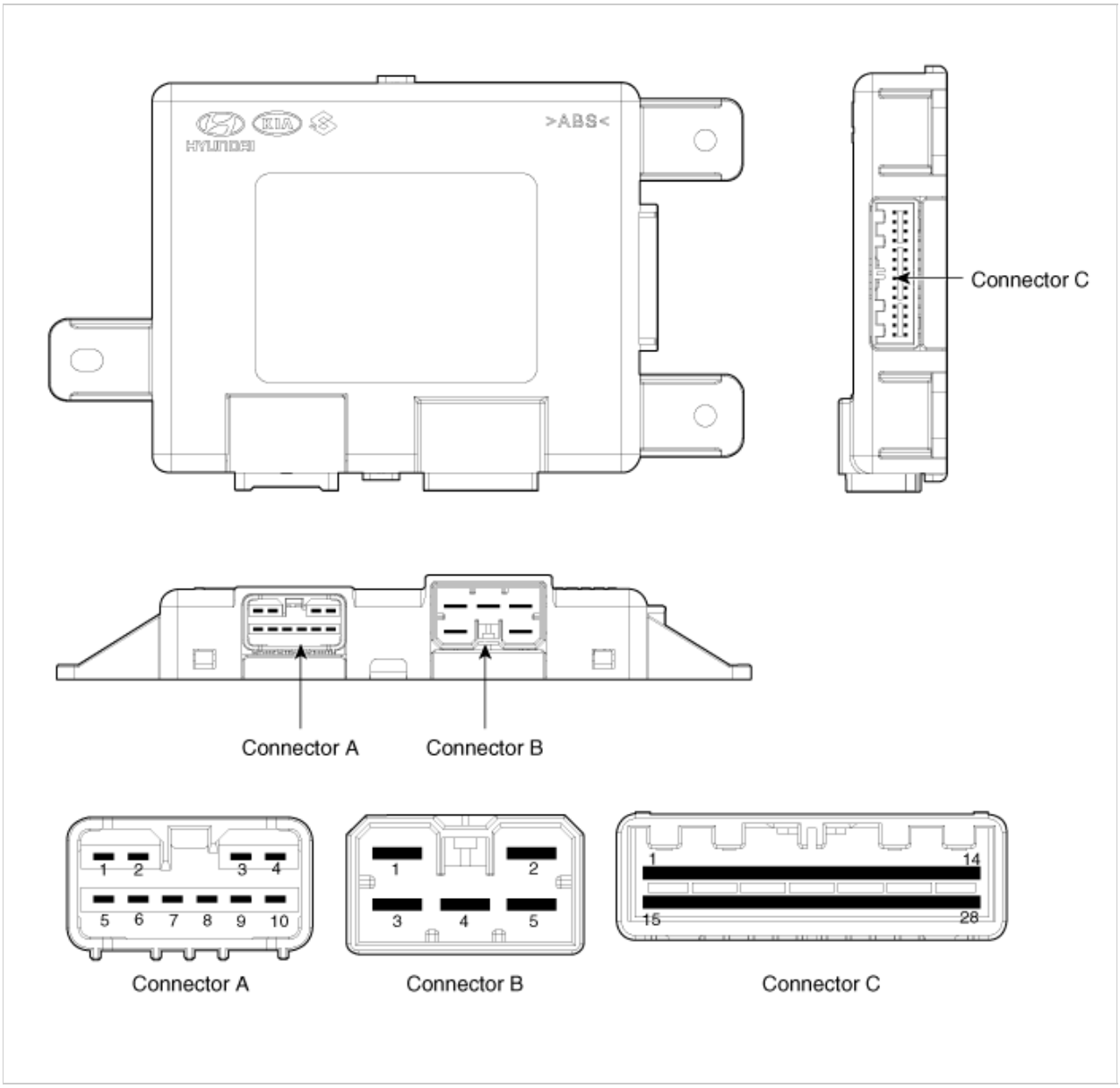
   Operation time chart



Operation Linked with Getting On/ Getting Off

1. Returning motion to backwards during getting off and to forwards during getting on (applied only to slide).
2. It is available when the automatic SET message transmitted from the driver seat power window switch (DDM) is ON.
3. Operation starts when the engine is off and driver seat door is opened.
4. Moving to the targeted position of ACC ON.
5. Conditions for prohibiting operation.
   – Vehicle speed is 3km/h or more.
   – Power seat manual control switch is operated.
   – Reproduction command is received while getting on the vehicle.
   – Driver settings menu (USM) is OFF.

- Components



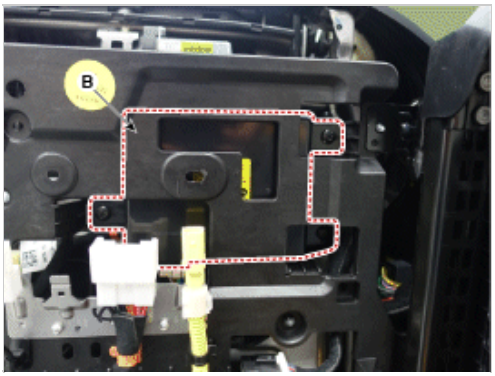
IMS input/output pin information

No	Connector A	Connector B	Connector C
1	Cushion extension moter (Front)	B+ (Power)	Seat slide motor switch (Front)
2	Seat recline motor (Front)	Ground (Power)	Seat recline switch (Front)
3	Seat height motor (Up)	B+ (Power)	Seat tilt switch (Up)
4	Seat slide motor(Front)	-	Seat height switch (Up)
5	Seat Cushion extension moter (Rear)	Ground	Seat cushion extension switch (Front)
6	Seat recline motor (Rear)		B_CAN (High)
7	Seat tilt motor (Up)		B_CAN (Low)
8	Seat tilt motor (Down)		Lumber motor (Up)
9	Seat height motor (Down)		Lumber motor (Down)
10	Seat slide motor (Rear)		Seat slide sensor
11			Seat tilt sensor
12			-
13			Seat position sensor power
14			IGN 1
15			Seat slide switch (Rear)
16			Seat recline switch (Rear)

17			Seat tilt switch (Down)
18			Seat height switch (Down)
19			Seat cushion extension switch (Rear)
20			Ground
21			Lumber motor (Low)
22			IMS switch 2
23			-
24			Seat recline sensor
25			Seat height sensor
26			-
27			-
28			Battery (+)

- Removal

1. Remove the negative (-) battery terminal.
2. Remove the front seat assembly.
   (Refer to Body - "Front Seat Assembly")
3. Remove the IMS module (B) after disconnecting the connector and loosening the screws (3EA).



- Installation

1. Install the IMS module after reconnecting the connector.
2. Install the driver seat.

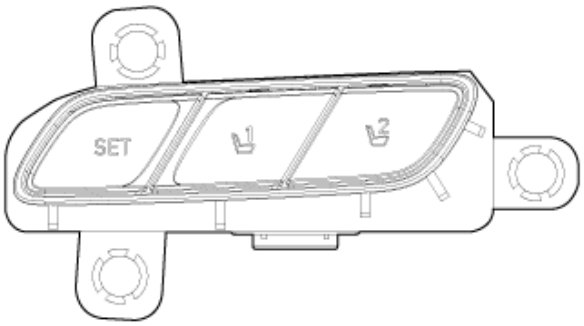
NOTICE

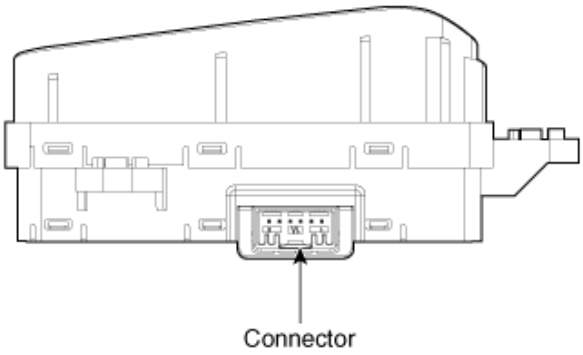
– Make sure the IMS module connectors and related connectors are plugged in properly.

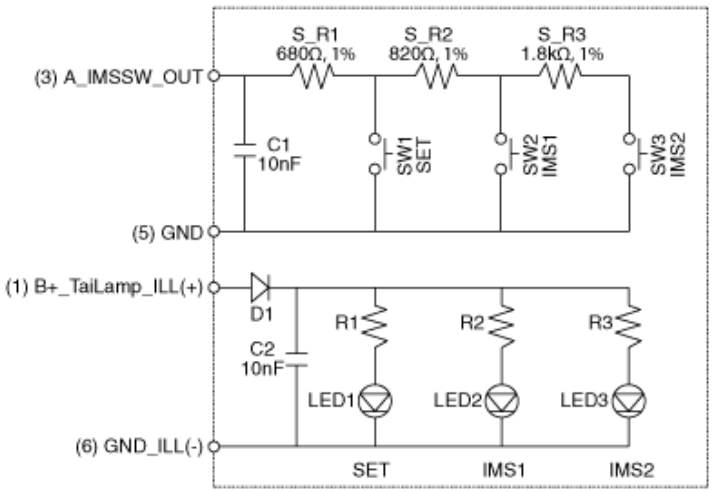
– Check that IMS system operates normally.

3. Connect the negative (-) battery terminal.

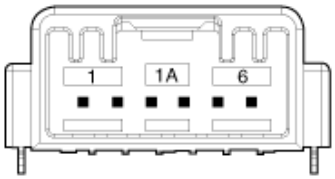
- Components







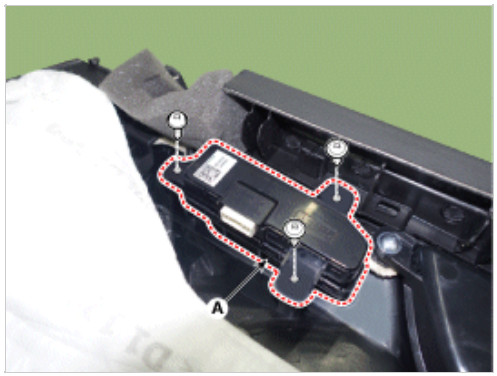
Connector



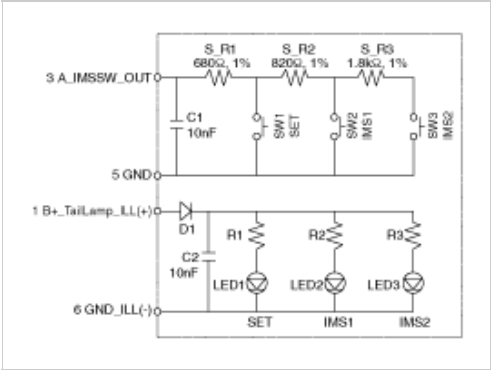
Pin	Description
1	Tail illumination (+)
2	-
3	IMS switch
4	-
5	Ground
6	Tail illumination (-)

- Inspection

1. Disconnect the IMS control switch connector.

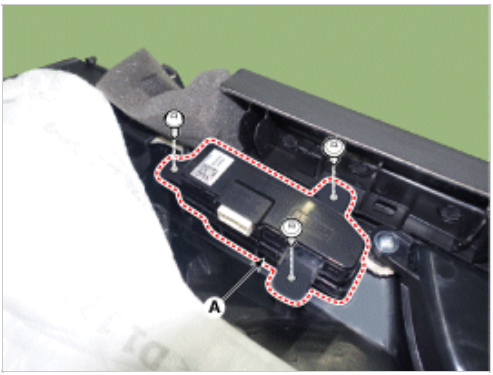


2. With the power IMS control switch in each position, make sure that continuity exists between the terminals below. If continuity is not as specified, replace the IMS control switch.



- Removal

1. Disconnect the negative (-) battery terminal.
2. Remove the front door trim.
   (Refer to Body - "Front Door Trim")
3. Disconnect the IMS switch connector (A) and then remove the IMS switch (A).



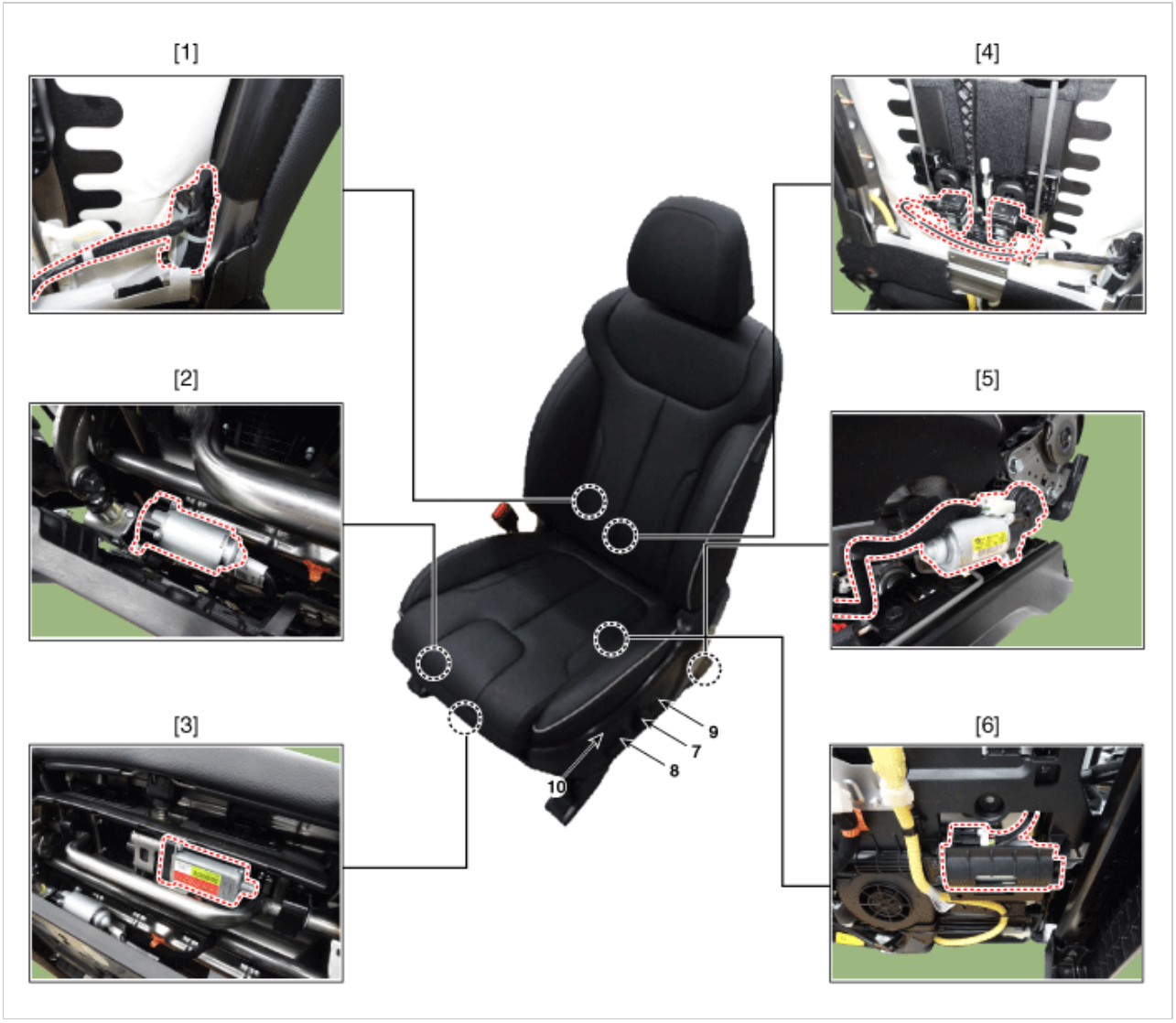
- Installation

NOTICE

– Make sure that the IMS control switch connectors and related connectors are plugged in properly.
– Check the IMS control switch operates normally.

1. Connect the connectors and reassemble the IMS control switch.
2. Reassemble the front door trim.
3. Connect the negative (-) battery terminal.

- Component Location

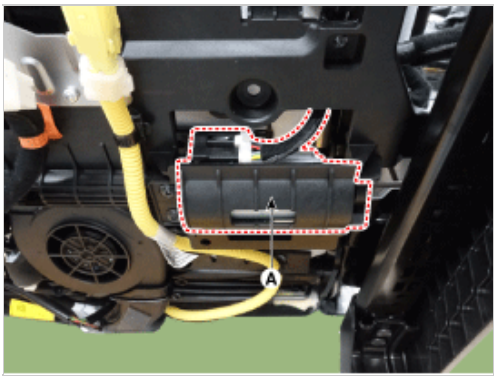


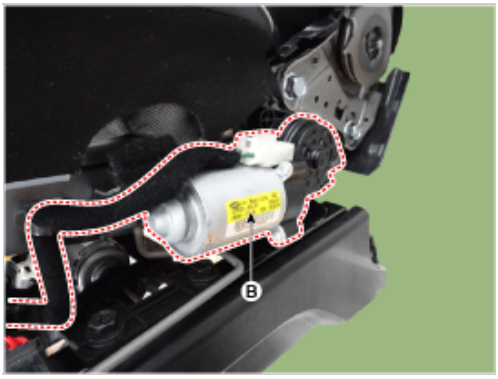
1. Backlest motor
2. Front height motor
3. Cushion extension motor
4. Lumber support motor
5. Rear height motor
6. Slide motor
7. Slide switch
8. Backrest switch
9. Lumber support switch
10. Cushion extension switch

- Inspection

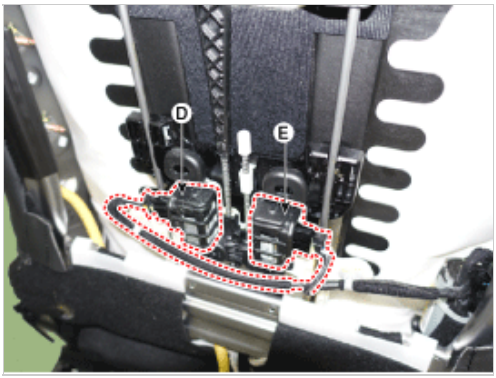
Power Seat Motor

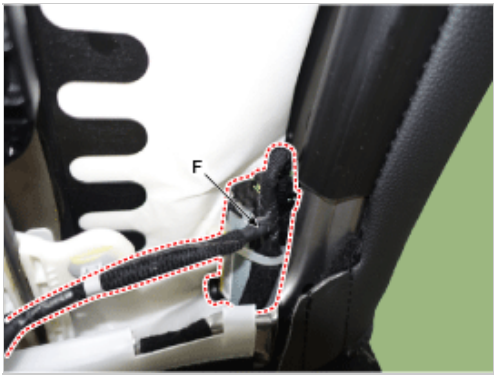
1. Disconnect the connectors for each motor.
   (Refer to Body - "Front Seat Assembly")
   A : Slide motor
   B : Rear height motor
   C : Front height motor
   D : Lumber support motor (Vertical)
   E : Lumber support motor (Horizontal)
   F : Backlest motor
   G : Cushion extension motor


A

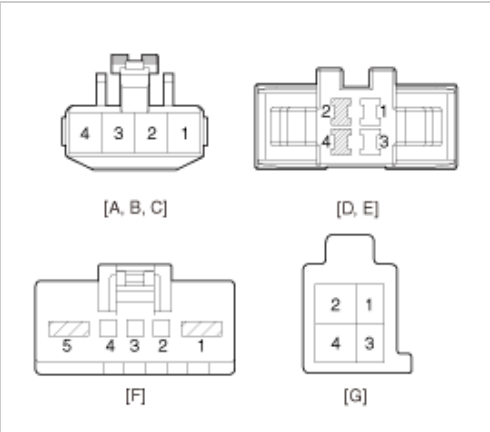

B

C


D
E


F

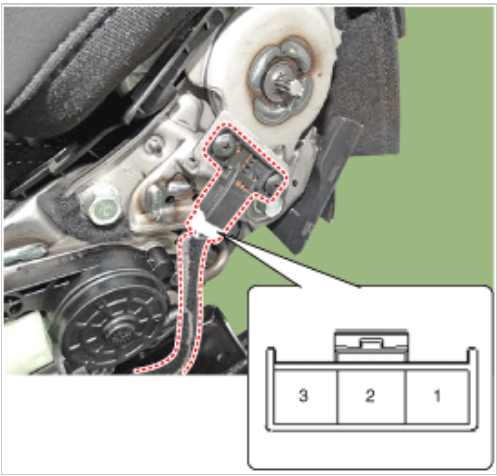
2. With the battery connected directly to the motor terminals, check if the motors run smoothly.
3. Reverse the connections and check that the motor turns in reverse.
4. If there is an abnormality, replace the motors.



Position \ Terminal		+	-
Slide motor A	Forward	4	1
	Backward	1	4
Rear height motor B	Up	1	4
	Down	4	1
Front height motor C	Up	4	1
	Down	1	4
Lumber support motor D (Vertical)	Up	4	2
	Down	2	4
Lumber support motor E (Horizontal)	Forward	4	2
	Backward	2	4
Backlest motor F	Forward	5	1
	Backward	1	5
Cushion extension motor G	Forward	4	2
	Backward	2	4

Reclining Motor Limit Switch

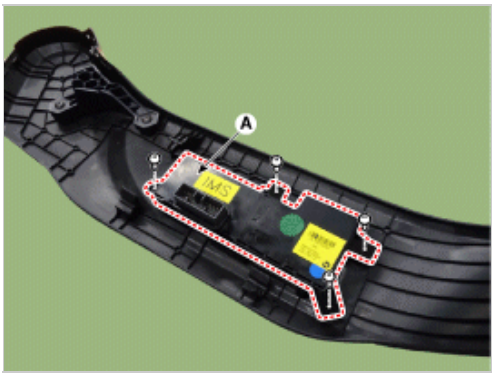
1. Disconnect the limit switch and operate the limit switch.
2. Check for continuity between the terminals.
3. Make sure that the seat operation is normal in the reverse after the maximum operation.
4. If there is an abnormality, replace the limit switch.



Terminal / Position	1	2	3
Forward		○	○
Neutral	○	○	○
Backward	○	○	

- Removal

1. Disconnect the negative (-) battery terminal.
2. Remove the front seat shield outer cover.
   (Refer to Body - "Front Seat Shield Outer Cover")
3. Remove the power seat control switch (A) after loosening the screws.

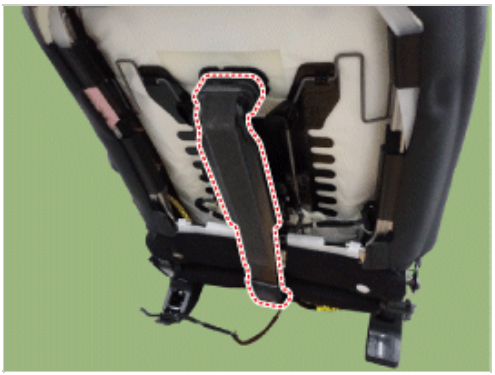


- Installation

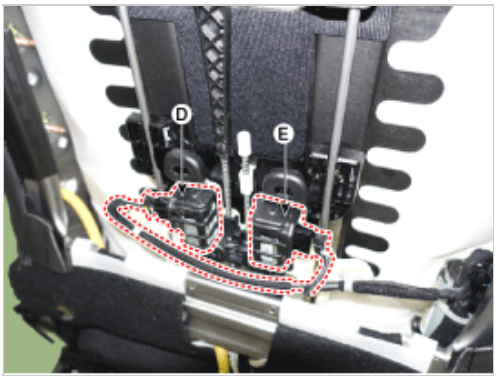
1. Install the power seat control switch after connecting the connector.
2. Install the front seat shield outer cover.
3. Connect the negative (+) battery terminal.

- Removal

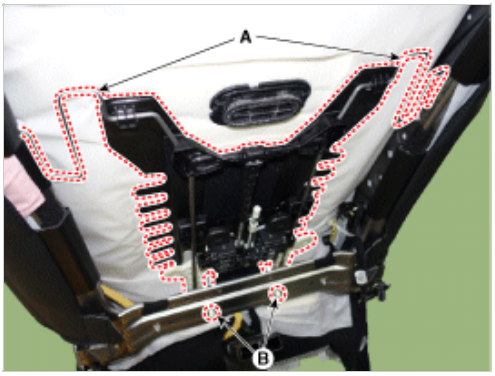
1. Disconnect the negative (-) battery terminal.
2. Remove the front seat back cover.
   (Refer to Body - "Front Seat Back Cover")
3. Remove the air duct.

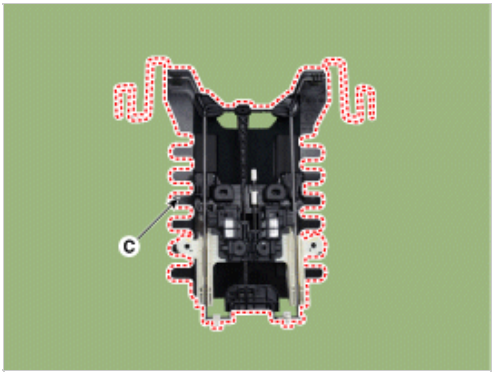


4. Disconnect the lumber support motor connector (D) & (E).



5. Remove the lumber support assembly (C) after removing the rod (A) & mounting fasner (B).

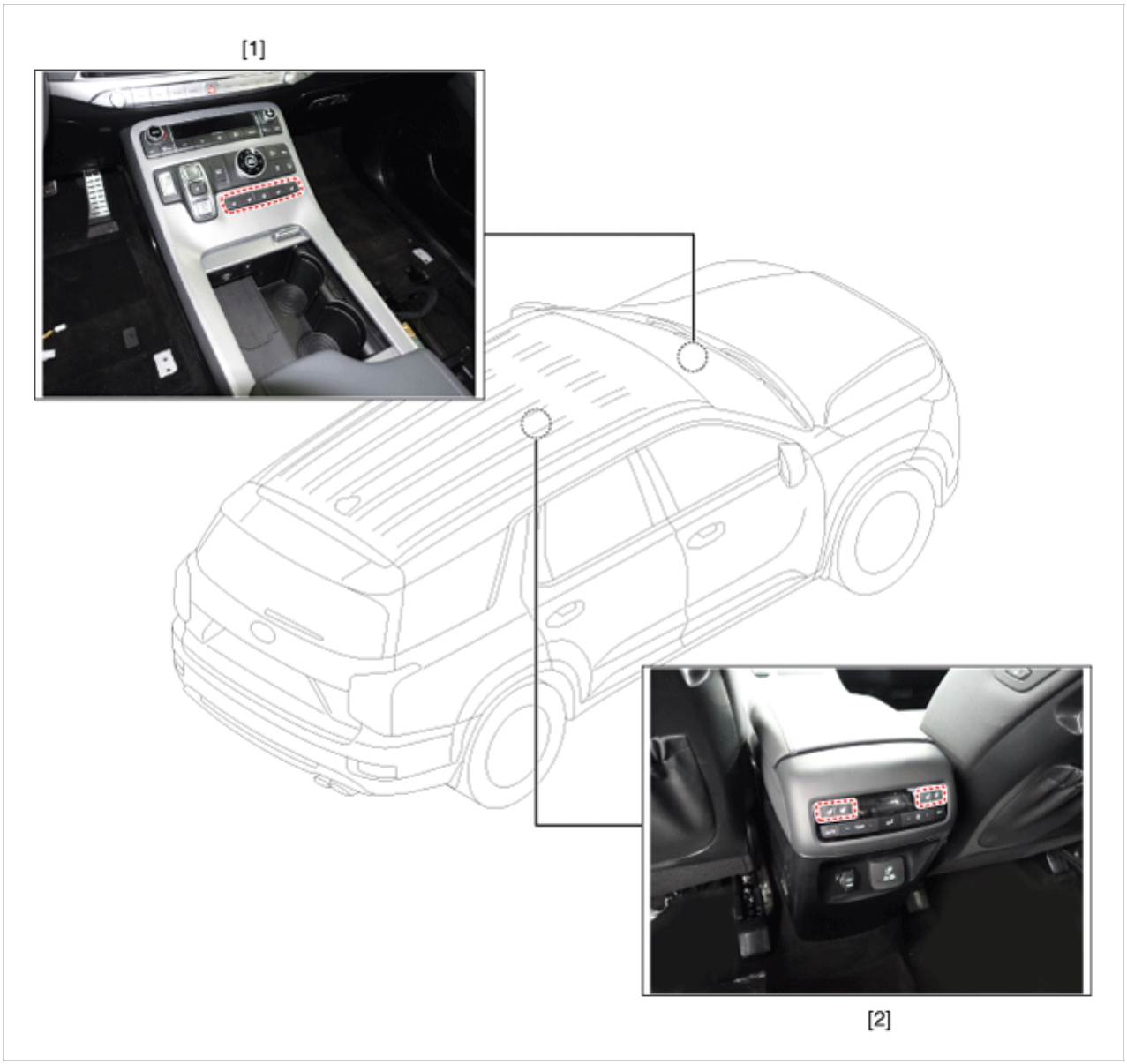




- Installation

1. Install the lumber support assembly.
2. Install the seat back cover.
3. Install the front seat assembly.

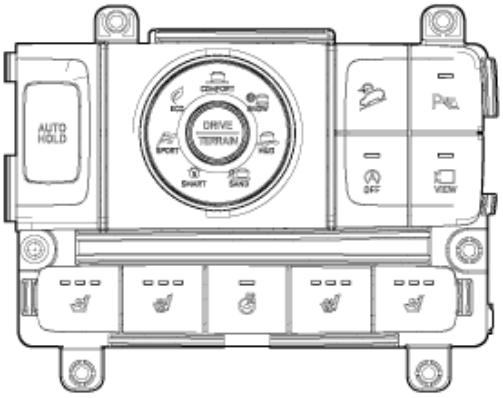
- Components

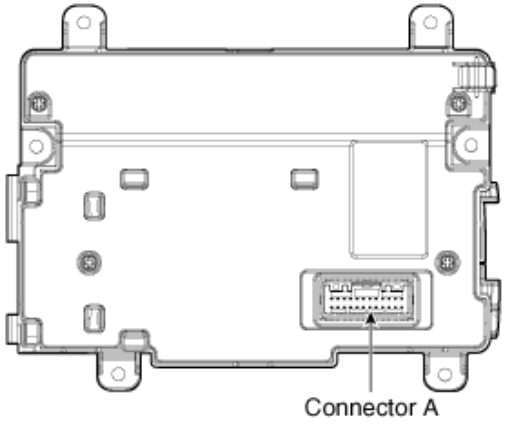


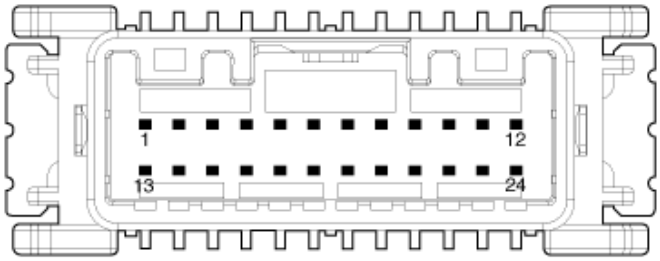
1. Front seat heater switch
2. Rear seat heater switch

- Circuit Diagram

Front Seat





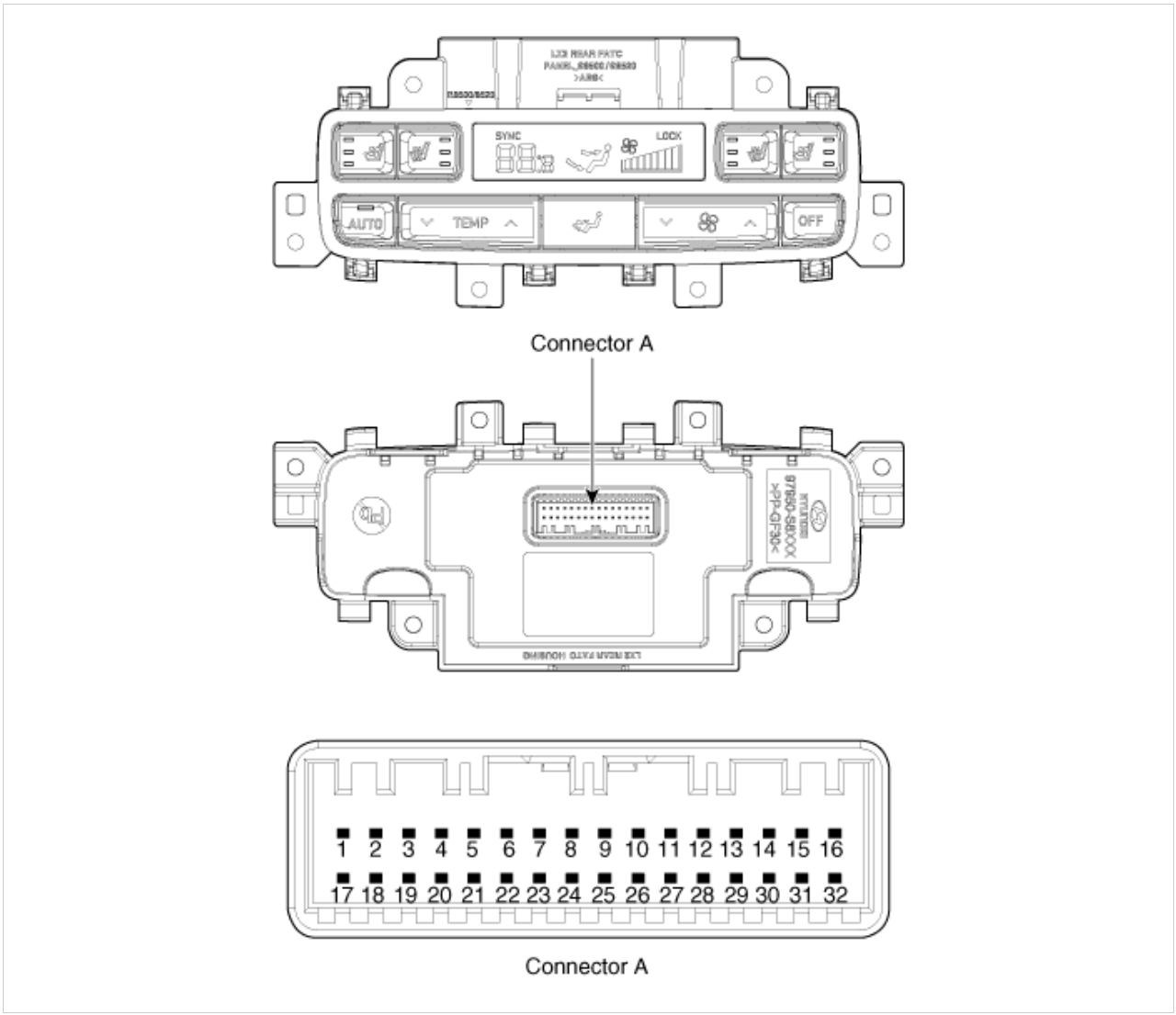


Connector A

No	Connector A
1	C_CAN (High)
2	C_CAN (Low)
3	-
4	LIN
5	-
6	Auto hold signal
7	-
8	Battery (+)
9	IGN
10	Illumination (+)
11	-
12	Illumination (-)
13	Ground
14	DETENT
15	-
16	PDW signal

17	Steering wheel heater signal
18	DBC signal
19	ISG signal
20	SVM/RVM signal
21	ISG indicator
22	SVM indicator
23	PDW indicator
24	Steering whell heater indicator

2nd Seat



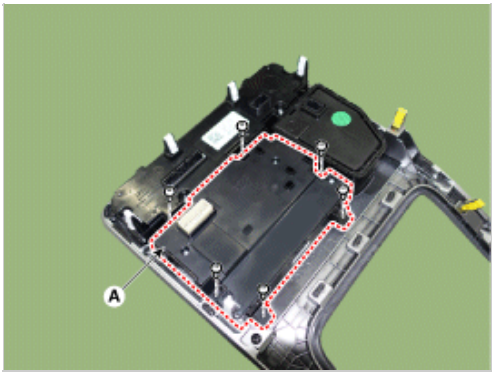
No	Connector A
1	Battery (+)
2	ISG Power(+)
3	Illumination (+)
4	Sensor REF (+5V)
5	Mode actuator feadback
6	Temperature actuator feedback
7	Mode actuator (Vent)
8	Mode actuator (Defrost)
9	Temperature actuator (Cooling)
10	Temperature actuator (Heating)
11	DETENT (-)

12	K-LINE
13	LIN line (Rear left seat)
14	LIN line (Rear right seat
15	-
16	Illumination (-)
17	IGN 2
18	IGN 1
19	Blower motor (+)
20	-
21	Rear FET (Drain feedback)
22	Rear FET (Gate)
23	Left heater swtich
24	Left heater indicator (High)
25	Left heater indicator (Middle)
26	Left heater indicator (Low)
27	Right heater swtich
28	Right heater indicator (High)
29	Right heater indicator (Middle)
30	Right heater indicator (Low)
31	Sensor ground
32	Ground

- Removal

Front seat

1. Disconnect the negative (-) batttery terminal.
2. Remove the floor console upper cover assembly.
   (Refer to Body - "Floor Console Assembly")
3. Remove the seat heater switch (A).



2nd Seat

1. Disconnect the negative (-) batttery terminal.
2. Remove the Rear A/C & Heater control unit.
   (Refer to Heating, Ventilation and Air Conditioning - "Heater & A/C Control Unit (Rear)")

- Installation

Front seat

1. Connect the seat heater switch connector.
2. Install the console upper switch assembly.

3. Connect the negative (-) batttery terminal.

2nd Seat

1. Install the Rear A/C & Heater control unit.
2. Connect the negative (-) batttery terminal.

- Components

Driver/Passenger Seat Heater

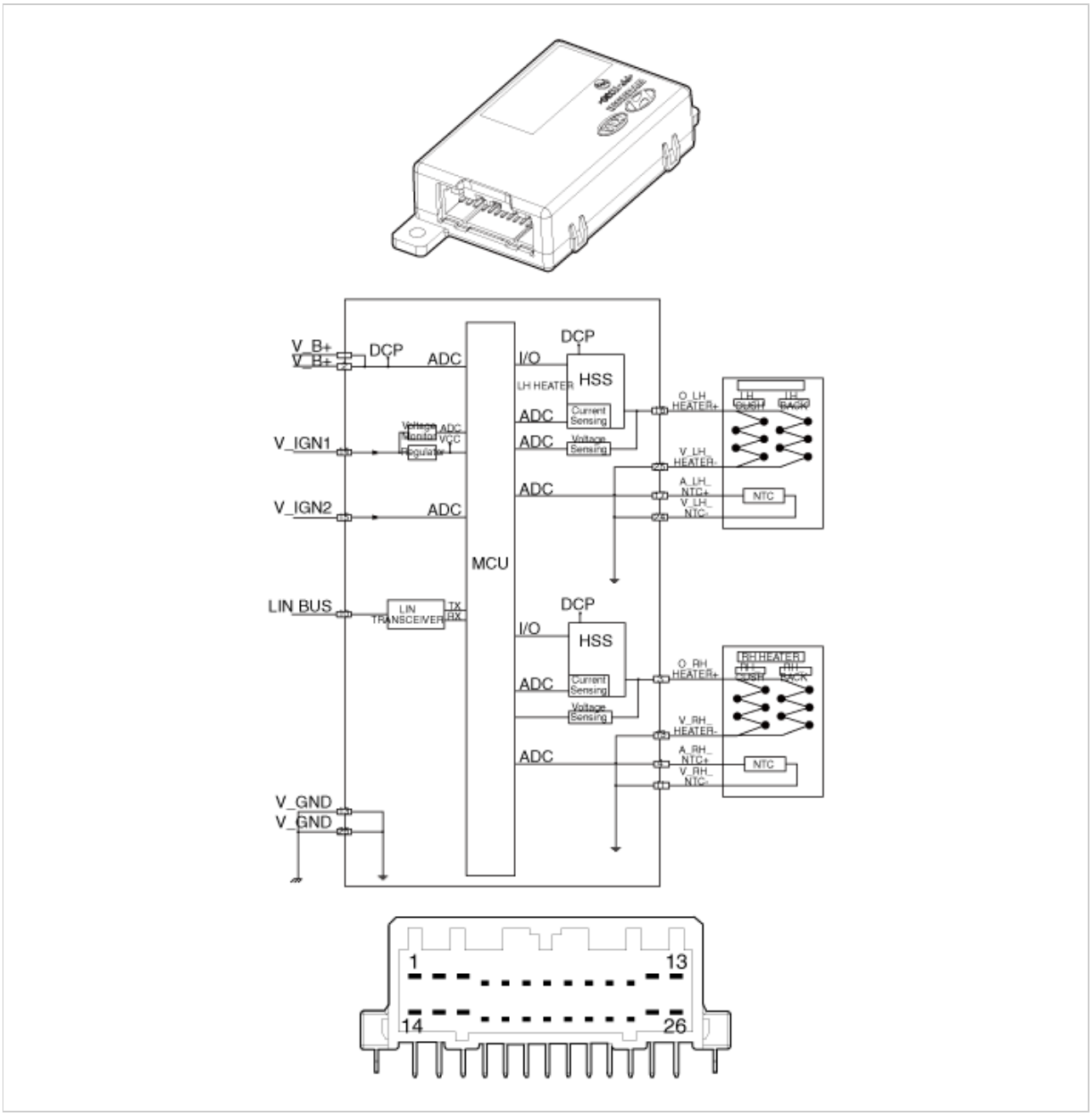
1. Seat cushion heater
2. Seat heater unit (Passenger only)
3. Seat back heater

Second Line Seat Heater

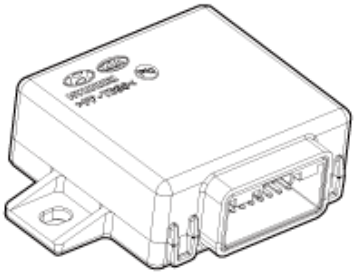
1. Seat heater unit
2. Seat back heater
3. Seat cushion heater

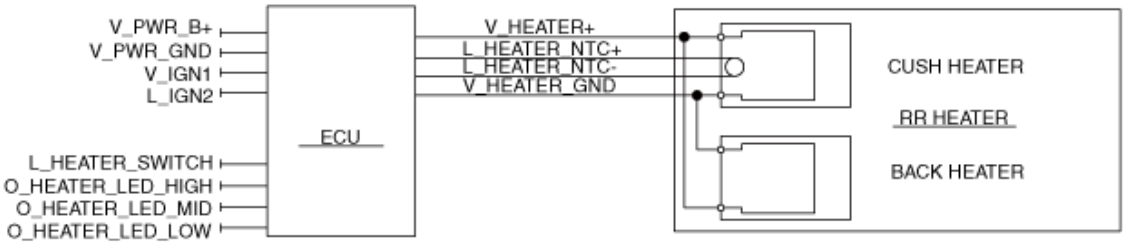
- Components

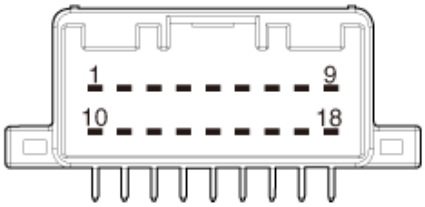
Driver/Passenger Seat Heater



Second Line Seat Heater





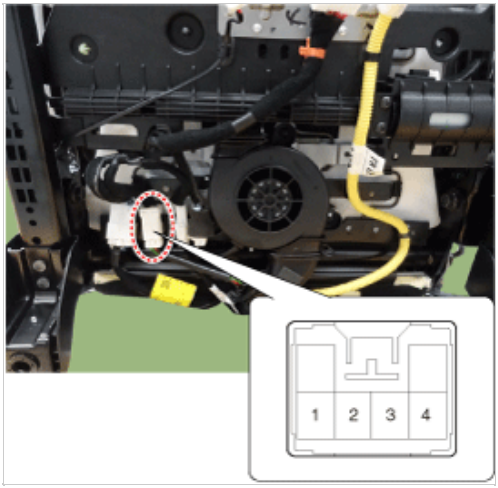


Pin	Description	Pin	Description
1	Battery (+)	10	Ignition 1
2	Heater power (+)	11	Ignition 2
3	-	12	Heater LED (Low)
4	-	13	Heater LED (Middle)
5	-	14	Heater LED (High)
6	Heater switch	15	Heater NTC (+)
7	-	16	-
8	-	17	Heater NTC (-)
9	Heater ground	18	-

- Inspection

Driver/Passenger

1. Check for continuity and measure the resistance between terminals.



No	Description	No	Description

1	Heater (+)	3	NTC (-)
2	NTC (+)	4	Heater (-)

Driver/Passenger	NTC Sensor (± 5%)
High	6.456 kΩ
Middle	8.303 kΩ
Low	10.0 kΩ

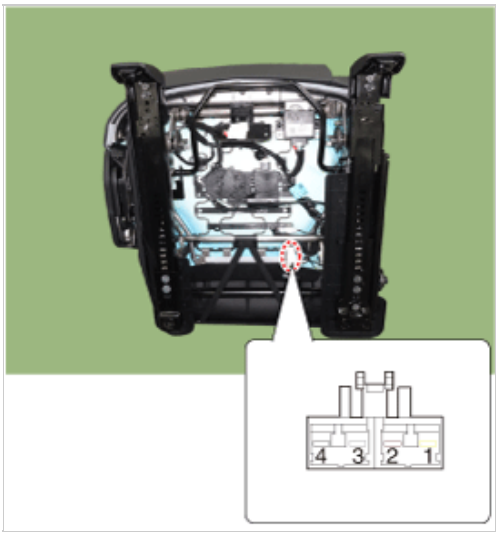
2. Operate the seat heater after connecting the connector, and then check the thermostat by measuring the temperature of seat surface.

Driver/Passenger	Fabric (± 2%)	Leather (± 2%)
High	42 / 50°C	42 / 50°C
Middle	39 / 45°C	39 / 45°C
Low	36 / 40°C	36 / 40°C

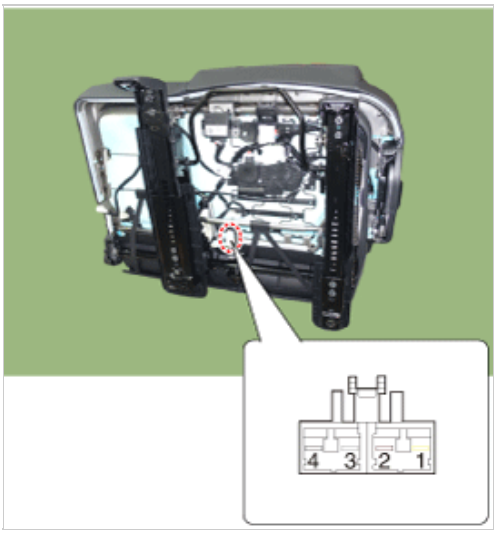
Second Line Seat Heater

1. Check for continuity and measure the resistance between terminals.

[RH]



[LH]



No.	Description	No.	Description
1	Heater (+)	3	NTC (-)

2	NTC (+)	4	Heater (-)

Driver / Passenger	NTC Sensor (± 5%)
High	4.909 kΩ
Middle	6.697 kΩ
Low	8.619 kΩ

2. Operate the seat heater after connecting the connector, and then check the thermostat by measuring the temperature of seat surface.

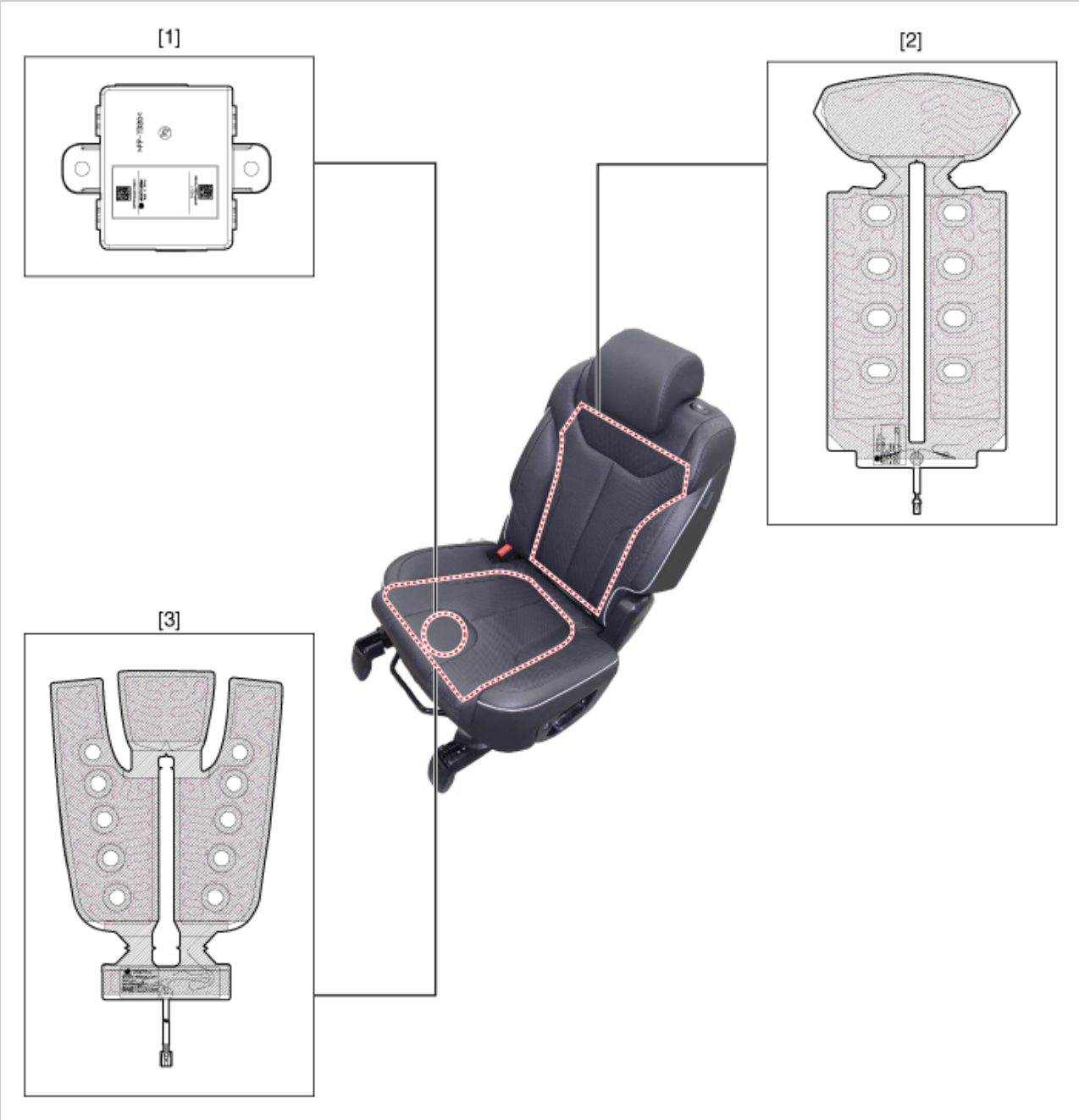
Driver/Passenger	Fabric (± 2%)	Leather (± 2%)
High	42 / 50°C	42 / 50°C
Middle	39 / 45°C	39 / 45°C
Low	36 / 40°C	36 / 40°C

- Components

Driver/Passenger Seat Heater

1. Seat cushion heater
2. Seat heater unit (Passenger only)
3. Seat back heater

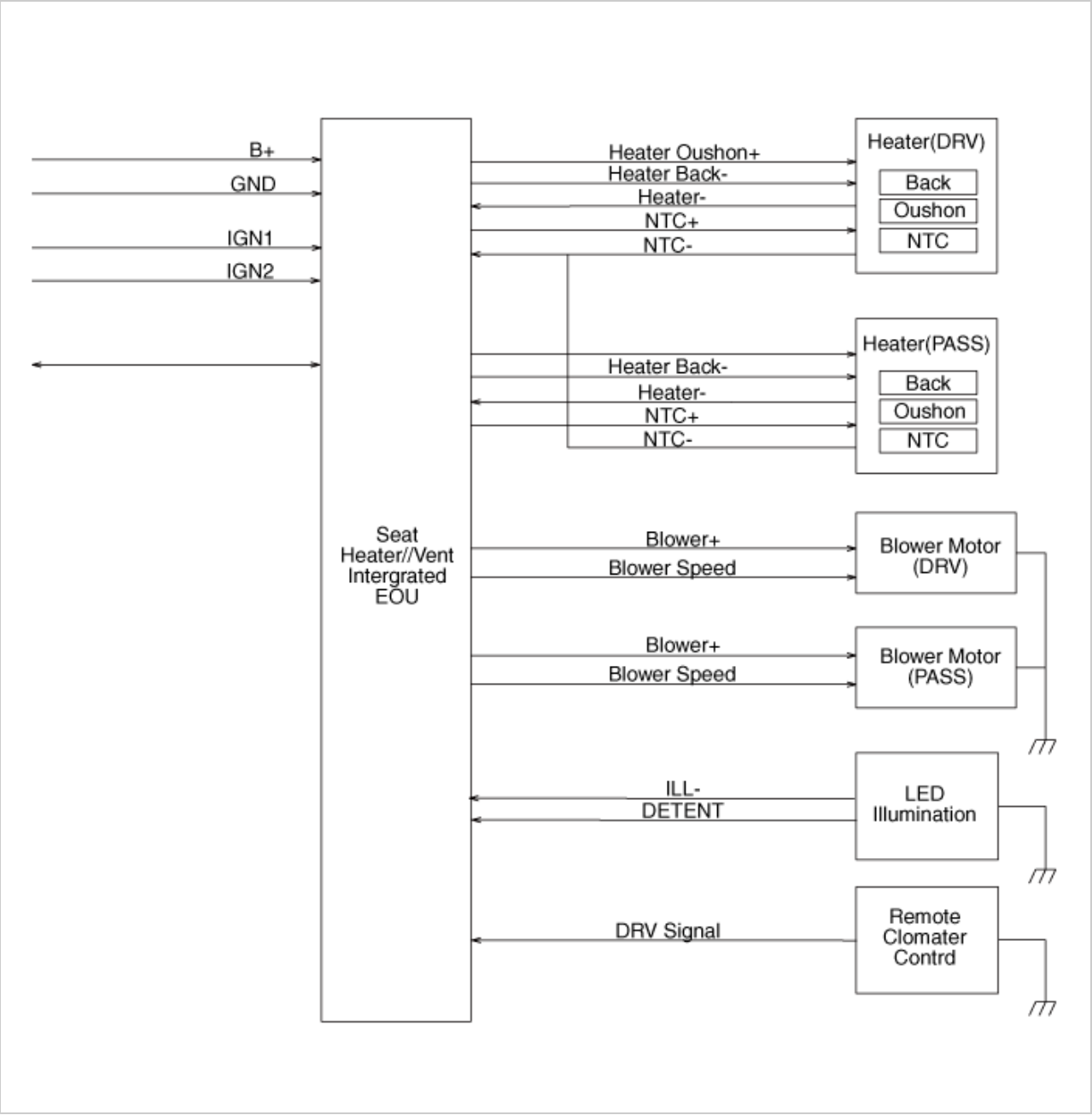
Second Line Seat Heater



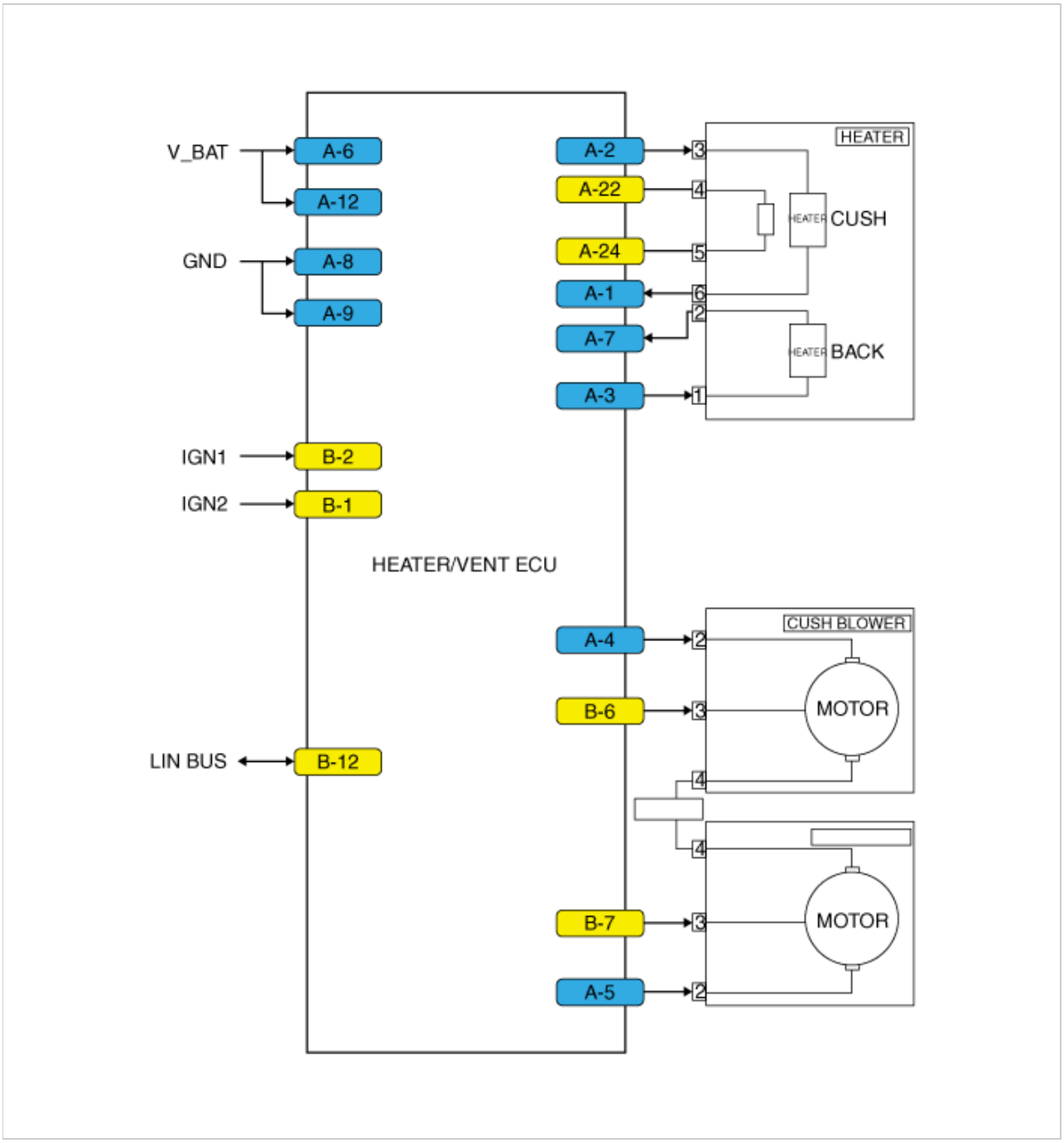
1. Seat heater unit (Passenger only)
2. Seat cushion heater
3. Seat back heater

- Circuit Diagram

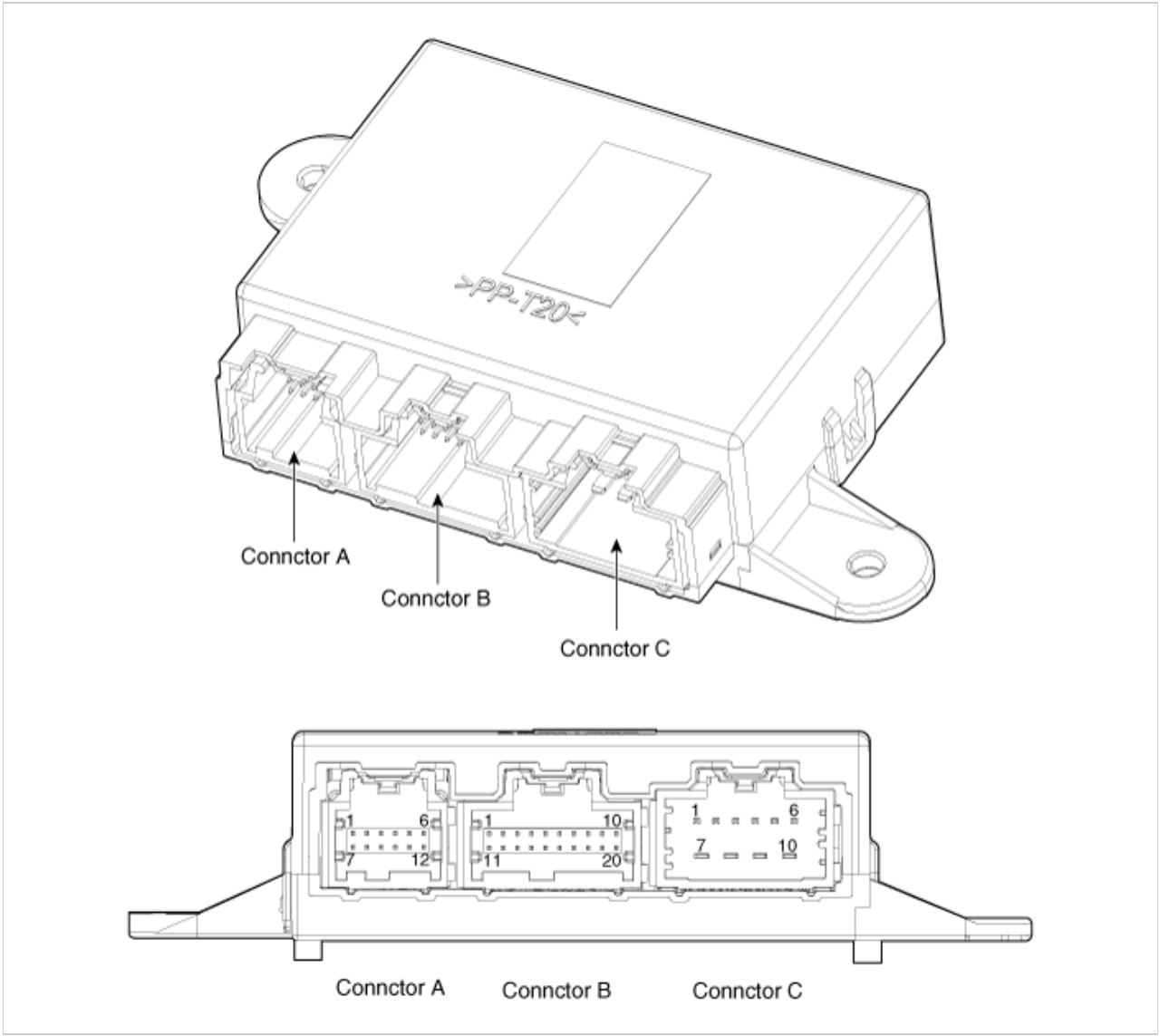
Driver/Passenger Seat Heater



Second Line Seat Heater

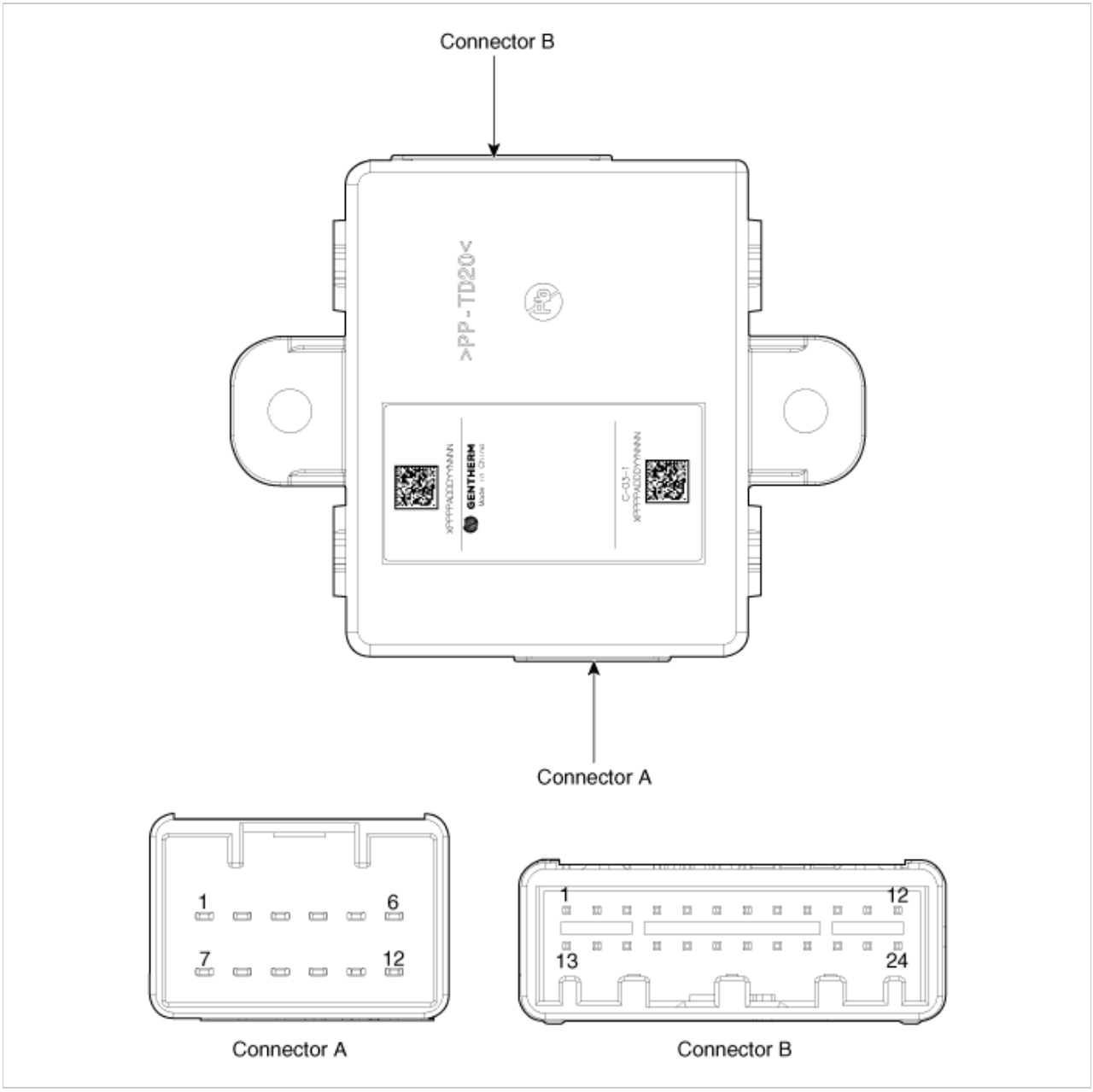


[Air Ventilation Seat Control Unit (Driver/Passenger Seat Heater)]



No	Connector A	Connector B	Connector C
1	-	-	Driver cushion heater
2	-	-	Driver back heater
3	-	-	Assist cushion heater
4	DETENT	-	Assist back heater
5	Illumination	-	Driver blower
6	Driver vent control PWM	LIN	Assist blower
7	Assist heater power	-	Battery (+)
8	Driver heater power	-	Driver heater (-)
9	-	-	Ground
10	-	IGN 1	Assist heater (-)
11	-	-	
12	-	-	
13		-	
14		-	
15		-	
16		-	
17		NTC (-)	
18		Assist NTC (+)	
19		Driver NTC (+)	
20		IGN 2	

[2nd line Air Ventilation Seat Control Unit



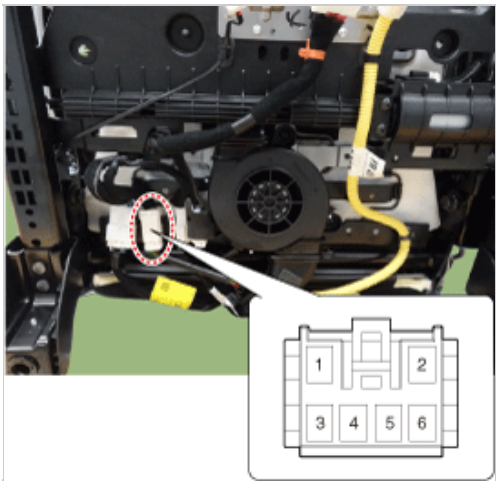
No	Connector A	Connector B
1	Heater (-)	Heater vent unit IGN 2
2	Cushion heater power	Heater vent unit IGN 1
3	Seat back heater power	-
4	Cushion blower power	-
5	Seat back blower power	-
6	Heater vent power	Cushion blower VSP
7	Heater (-)	Seat back blower VSP
8	Heater vent ground	-
9	Heater vent ground	-
10	-	-
11	-	-
12	Heater vent Power	LIN
13		-
14		-

15		-
16		-
17		-
18		-
19		-
20		-
21		-
22		NTC (+)
23		-
24		NTC (-)

- Inspection

Front Seat

1. Check for continuity and measure the resistance between terminals.



No	Description	No	Description
1	NTC (+)	4	Cushion heater (+)
2	-	5	Back heater (+)
3	NTC (-)	6	Ground

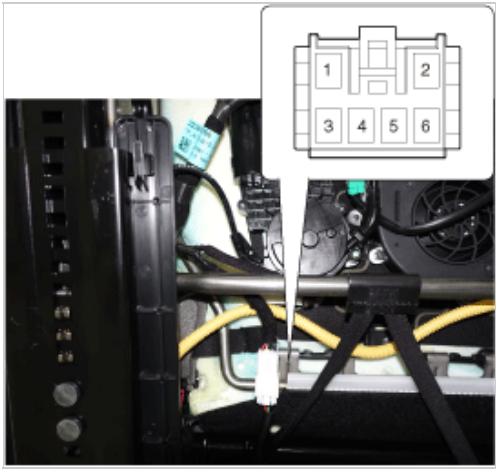
Driver / Passenger	NTC Sensor (± 5%)
High	1.693 kΩ
Middle	2.802 kΩ
Low	5.922 kΩ

2. Operate the seat heater after connecting the connector, and then check the thermostat by measuring the temperature of seat surface.

Driver / Passenger	Fabric (± 2%)	Leather (± 2%)
High	42 / 50°C	42 / 50°C
Middle	39 / 45°C	39 / 45°C
Low	36 / 40°C	36 / 40°C

2nd Line Seat

1. Check for continuity and measure the resistance between terminals.

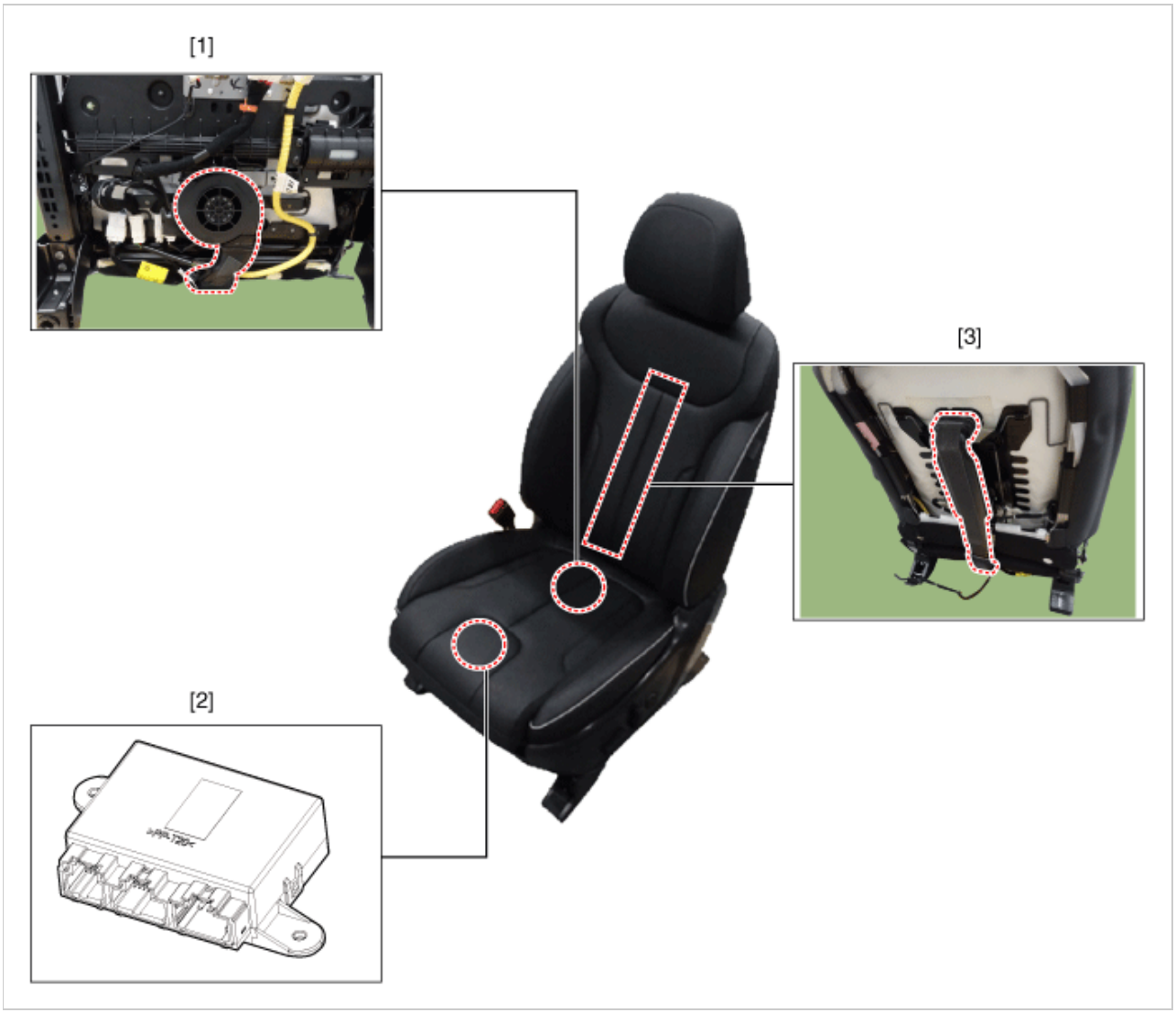


No	Description	No	Description
1	-	4	NTC (+)
2	-	5	NTC (-)
3	Heater power	6	Ground

Driver / Passenger	NTC Sensor (± 5%)
High	1.204 kΩ
Middle	3.213 kΩ
Low	6.472 kΩ

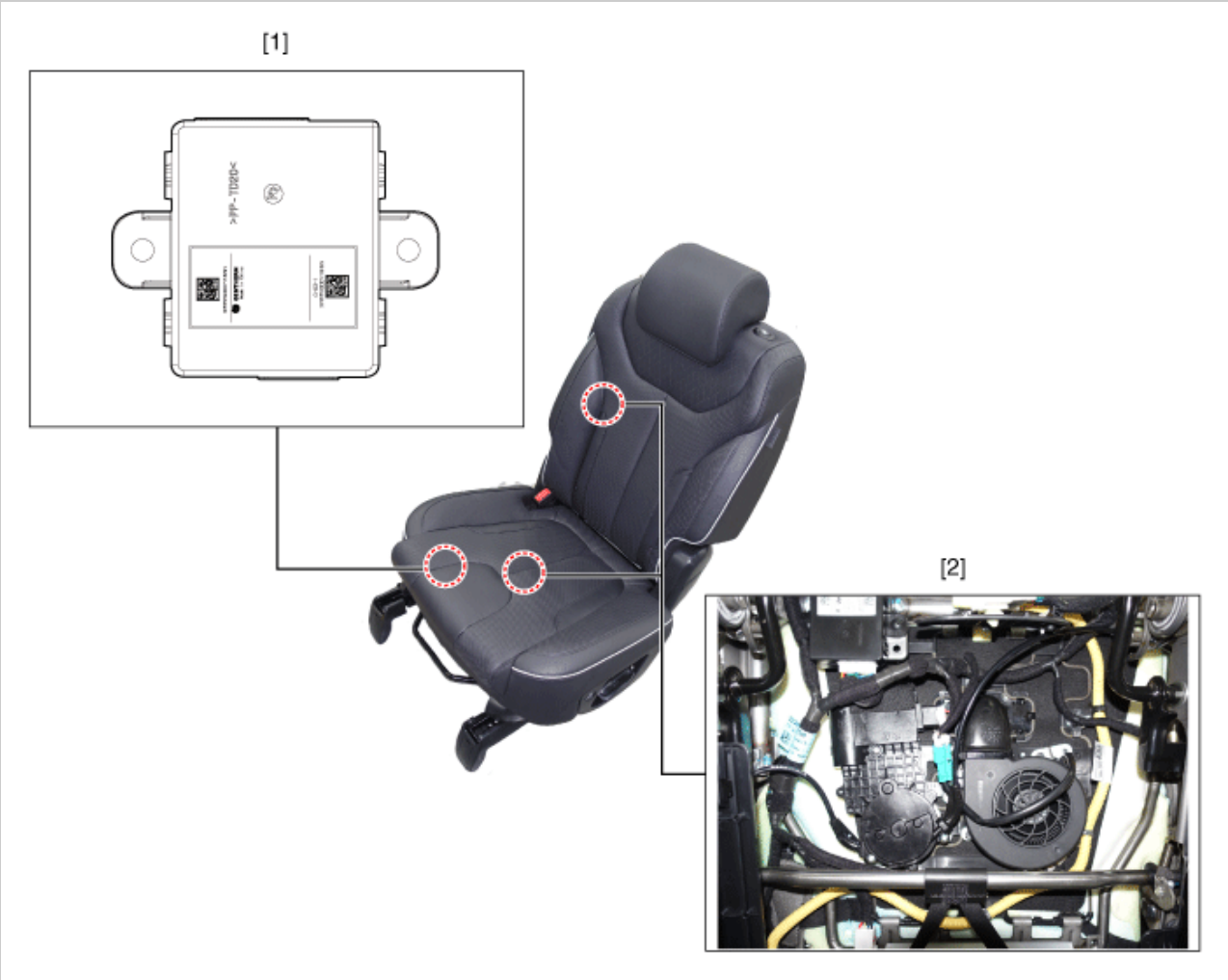
- Components (1)

Front seat



1. Air ventilation seat blower
2. Air ventilation seat control unit (Passenger only)
3. Air ventilation seat duct

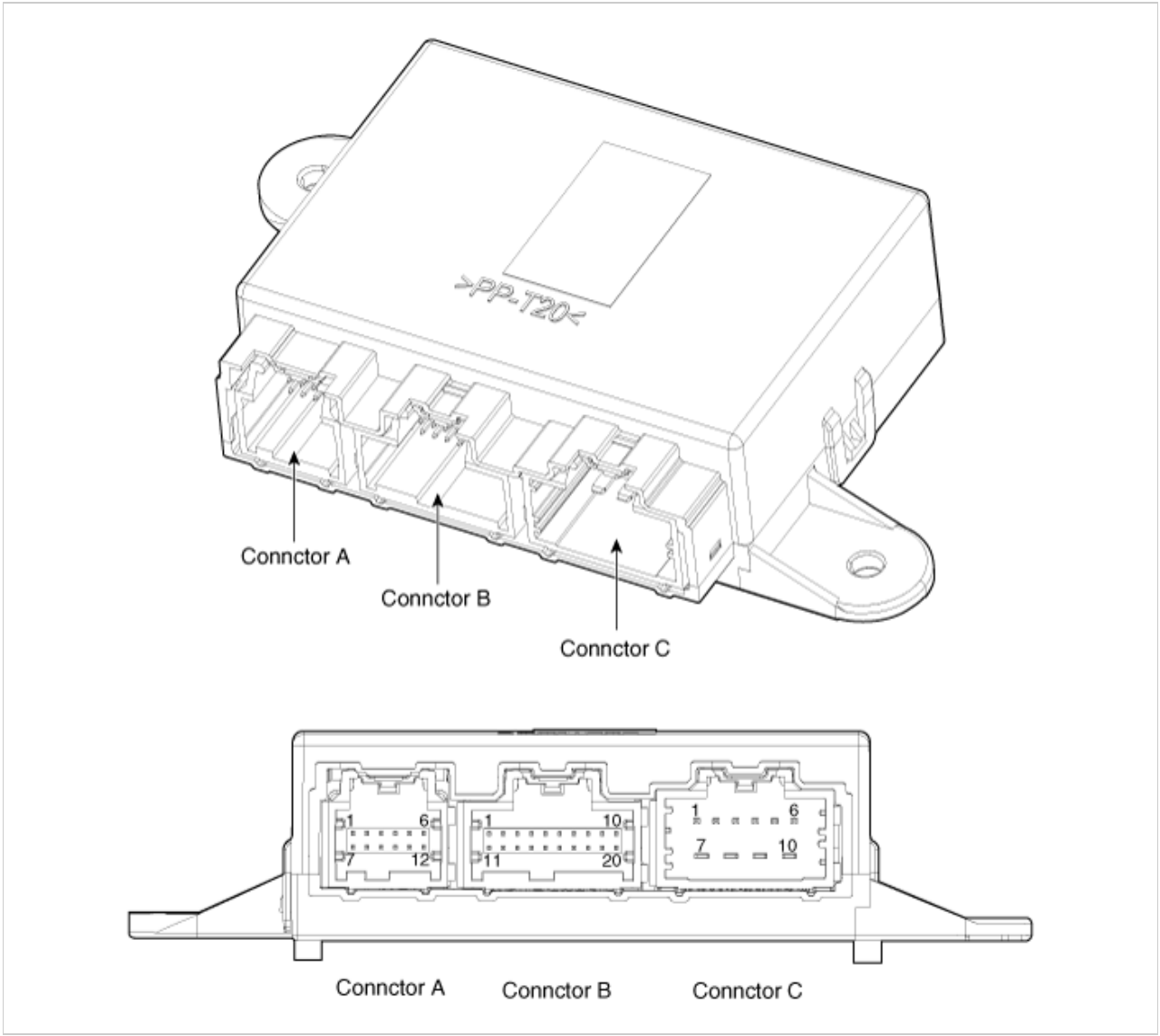
2nd Seat



1. Air ventilation seat control unit
2. Air ventilation seat blower

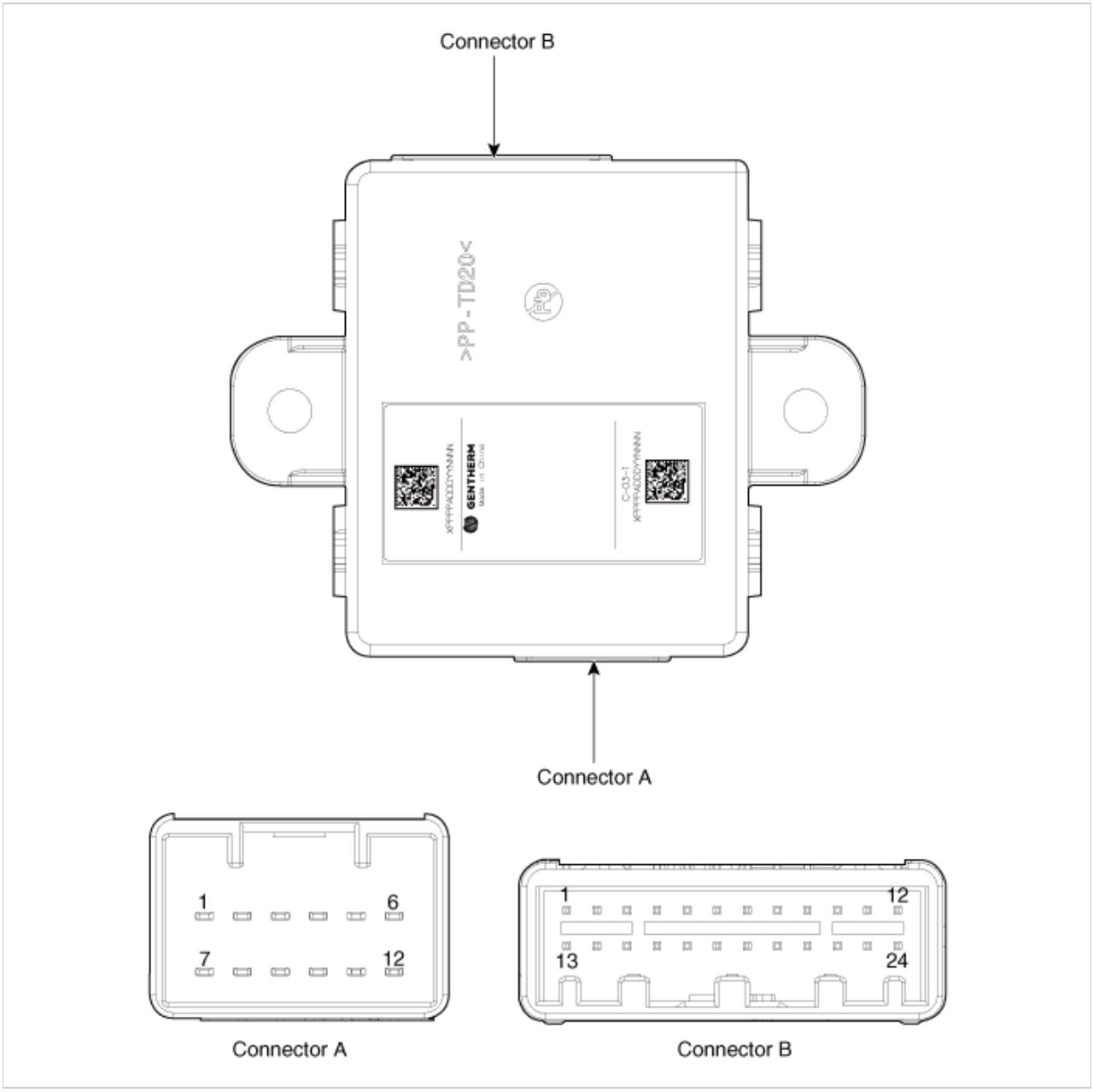
- Components (2)

Front seat



No	Connector A	Connector B	Connector C
1	-	-	Driver cushion heater
2	-	-	Driver back heater
3	-	-	Assist cushion heater
4	DETENT	-	Assist back heater
5	Illumination	-	Driver blower
6	Driver vent control PWM	LIN	Assist blower
7	Assist heater power	-	Battery (+)
8	Driver heater power	-	Driver heater (-)
9	-	-	Ground
10	-	IGN 1	Assist heater (-)
11	-	-	
12	-	-	
13		-	
14		-	
15		-	
16		-	
17		NTC (-)	
18		Assist NTC (+)	
19		Driver NTC (+)	
20		IGN 2	

[2nd line Air Ventilation Seat Control Unit



No	Connector A	Connector B
1	Heater (-)	Heater vent unit IGN 2
2	Cushion heater power	Heater vent unit IGN 1
3	Seat back heater power	-
4	Cushion blower power	-
5	Seat back blower power	-
6	Heater vent power	Cushion blower VSP
7	Heater (-)	Seat back blower VSP
8	Heater vent ground	-
9	Heater vent ground	-
10	-	-
11	-	-
12	Heater vent Power	LIN
13		-
14		-

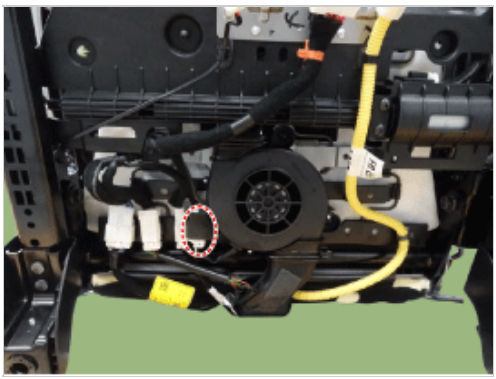
15		-
16		-
17		-
18		-
19		-
20		-
21		-
22		NTC (+)
23		-
24		NTC (-)

- Removal

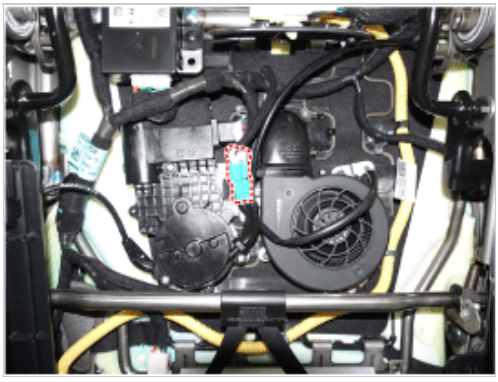
Cushion Blower

1. Remove the front seat assembly.
   (Refer to Body - "Front Seat Assembly")
2. Remove the cushion blower after loosening the screws(3EA) and disconnecting the connector.

[Front Seat]



[2nd Seat]

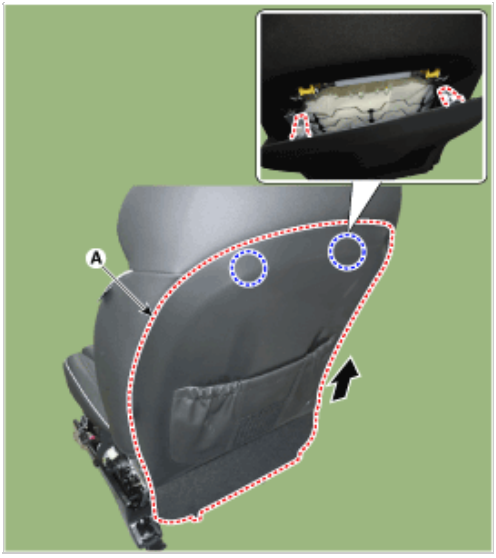


Air Duct

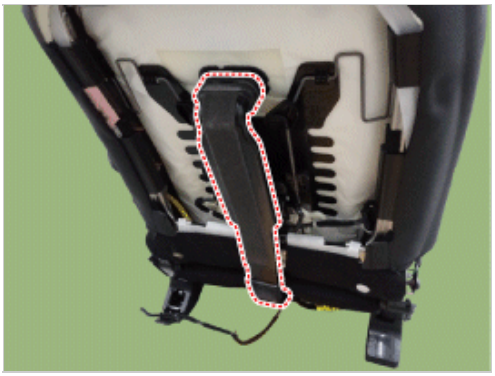
1. Remove the front seat assembly.
   (Refer to Body - "Front Seat Assembly")
2. Remove the seat back board (A).

⚠ CAUTION

- Grasp the both lower sides of back board with hands and then remove it in the direction of the arrow.
- Be careful not to damage the fixing clips.

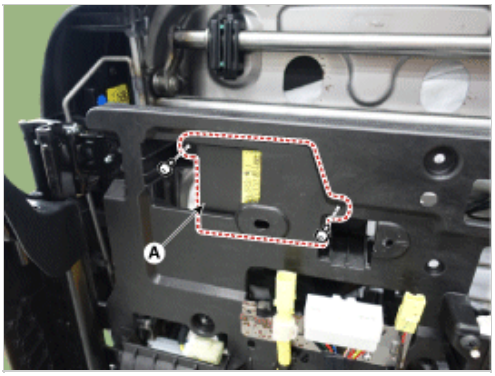


3. Remove the air duct after loosening the screws and disconnecting the connector.



Air Ventilation Unit

1. Remove the front seat assembly.
   (Refer to Body - "Front Seat Assembly")
2. Remove the air ventilation unit (A) after loosening the screws (2EA) and disconnecting the connector.



- Installation

Cushion Blower

1. Install the cushion blower.
2. Install the front seat assembly.

Air Duct

1. Install the air duct.

2. Install the seat back board.
3. Install the front seat assembly.

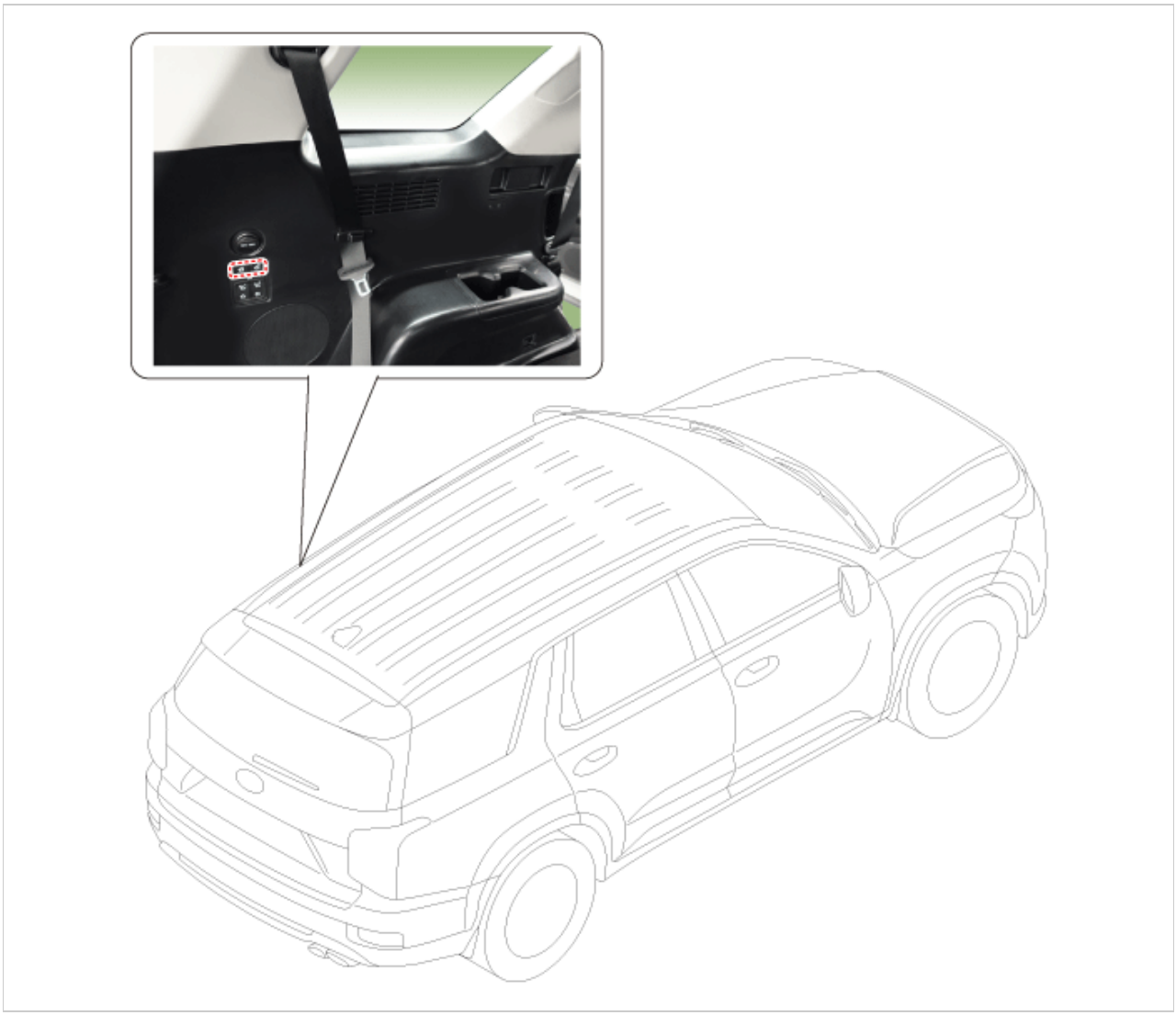
Air Ventilation Unit

1. Install the air ventilation unit.
2. Install the front seat assembly.

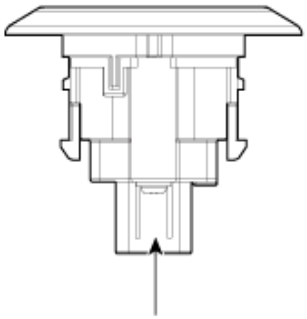
- Component Location

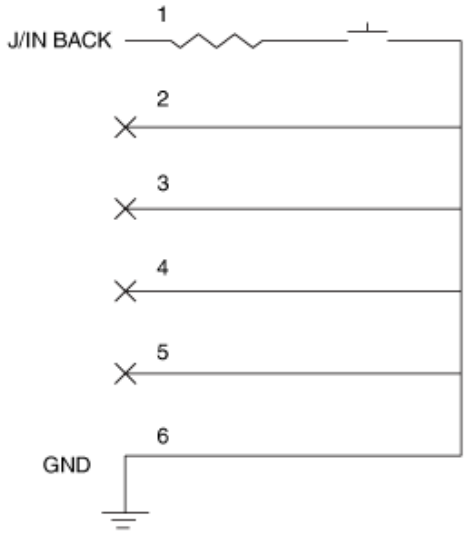
Second line Seat

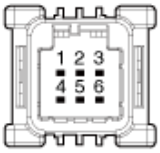
Luggage Side Trim



- Circuit Diagram



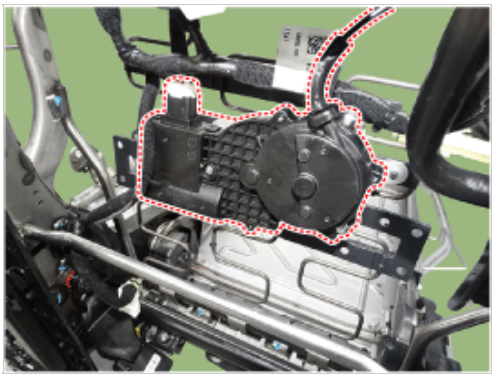


Connector A	
	
No.	Description
1	Walk in back switch
2	-
3	-
4	-
5	-
6	Ground

- Removal

Actuator

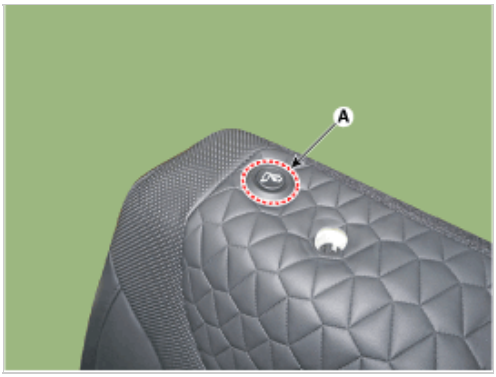
1. Remove the rear seat.
   (Refer to Body - "Rear Seat Assembly")
2. Disconnect the walk in actuator connector and then remove the actuator.



3. Remove the cable (A) and then separate the walk in actuator.

Upper Walk in Swtich

1. Remove the rear seat walk in switch (A).



2. Remove the walk in switch by using a flat-head screwdriver and then disconnect the walk in switch connector (A).

Lower Walk in Switch

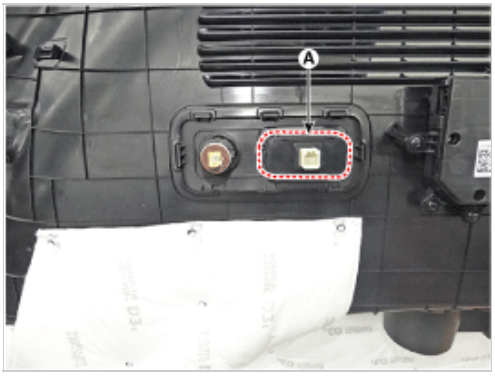
1. Loosen the screw and then remove the rear slide Knob (A).

2. Loosen the screw and then remove the rear seat slide outer cover (A).

3. Remove the walk in swtich (A) after loosening the connector.

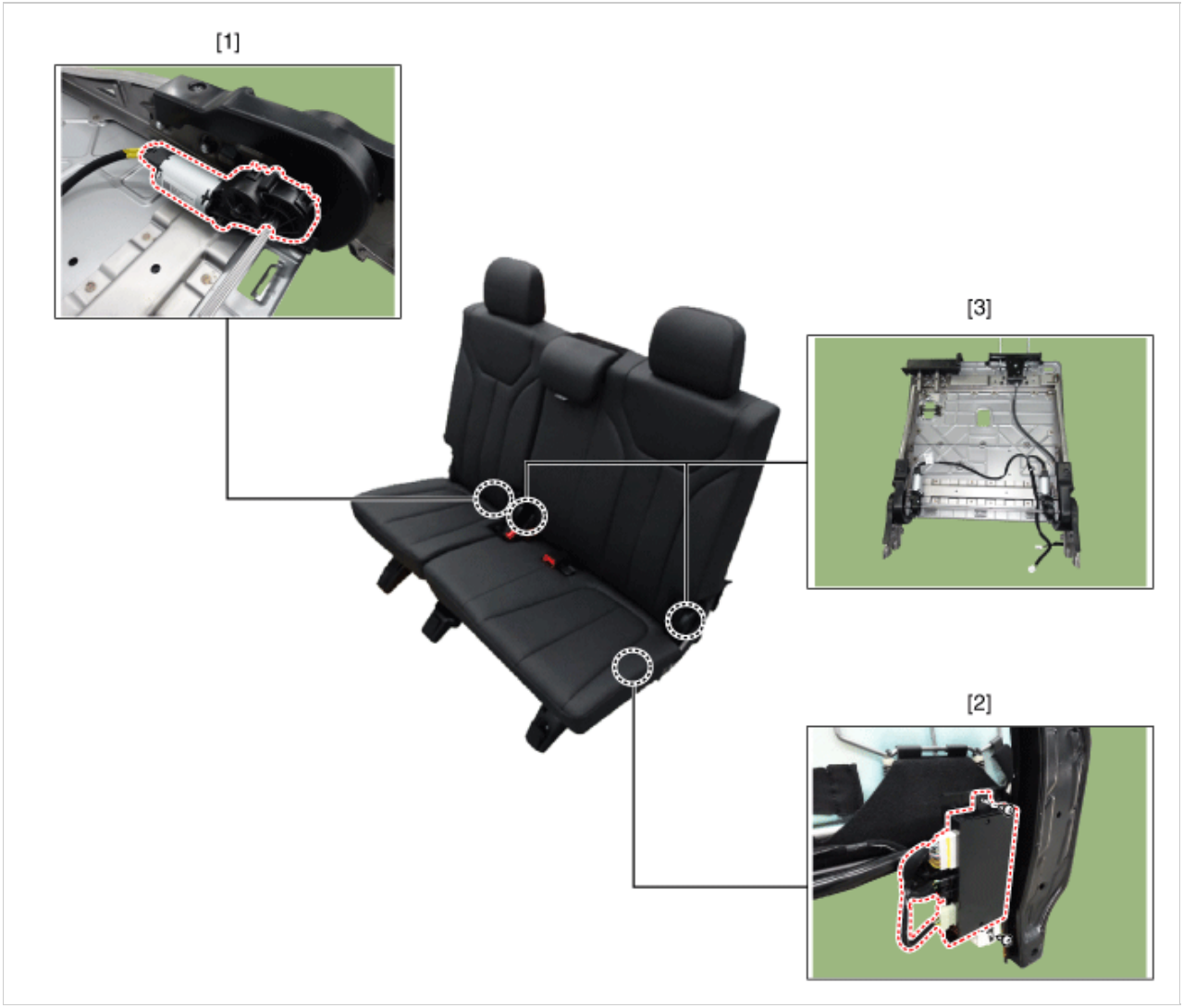
Luggage Trim Remote Folding Swtich

1. Remove the luggage side trim.
   (Refer to Body - "Luggage Side Trim")
2. Remove the luggage remote folding switch (A).



- Components

3rd Seat



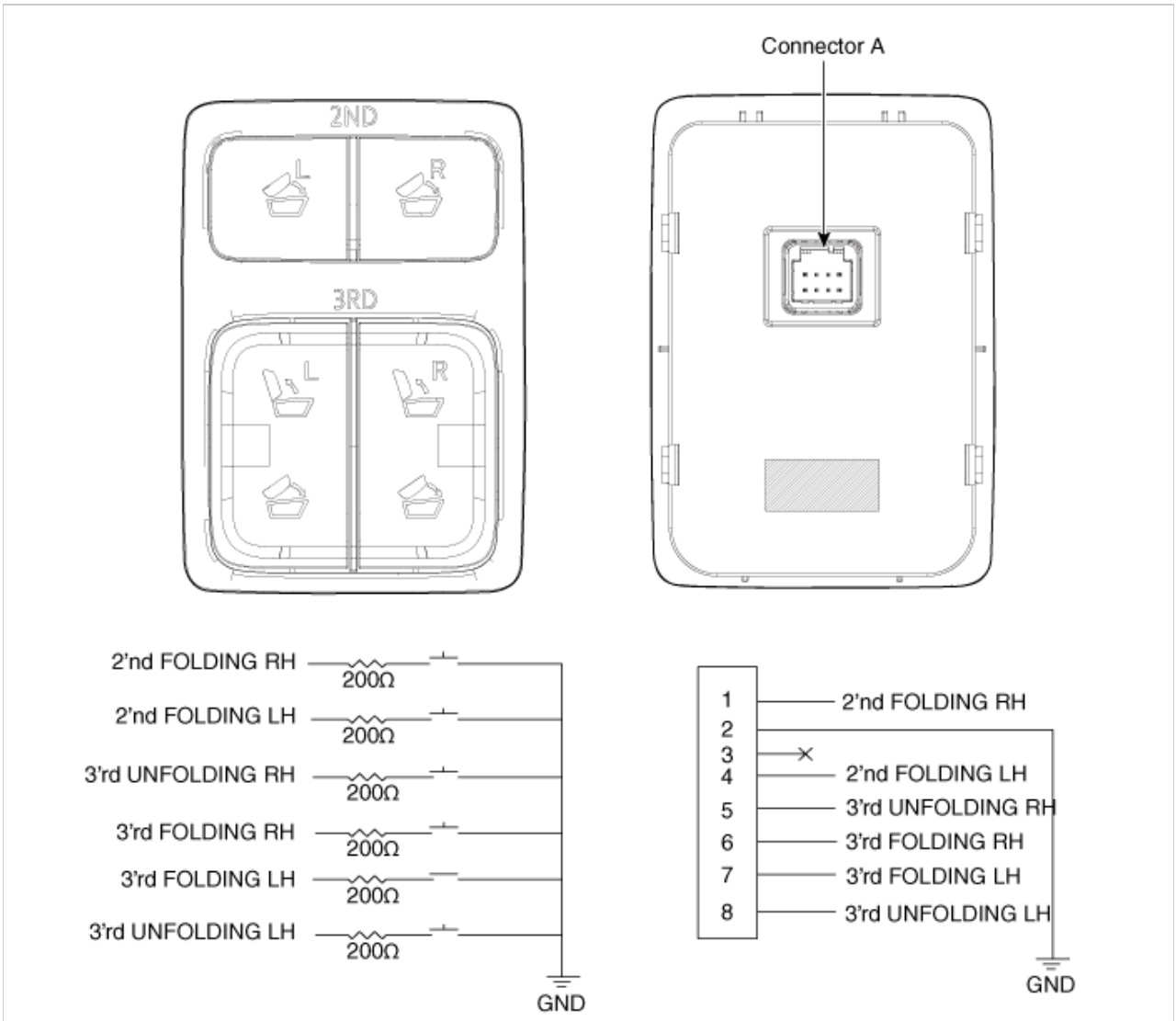
1. 3rd right folding motor
2. Folding seat control unit
3. 3rd left folding motor

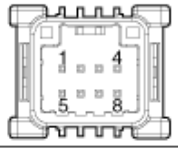
Luggage Side Trim

1. 2nd/3rd integrated seat switch (3rd Folding/Unfolding)
2. 3rd reclining switch

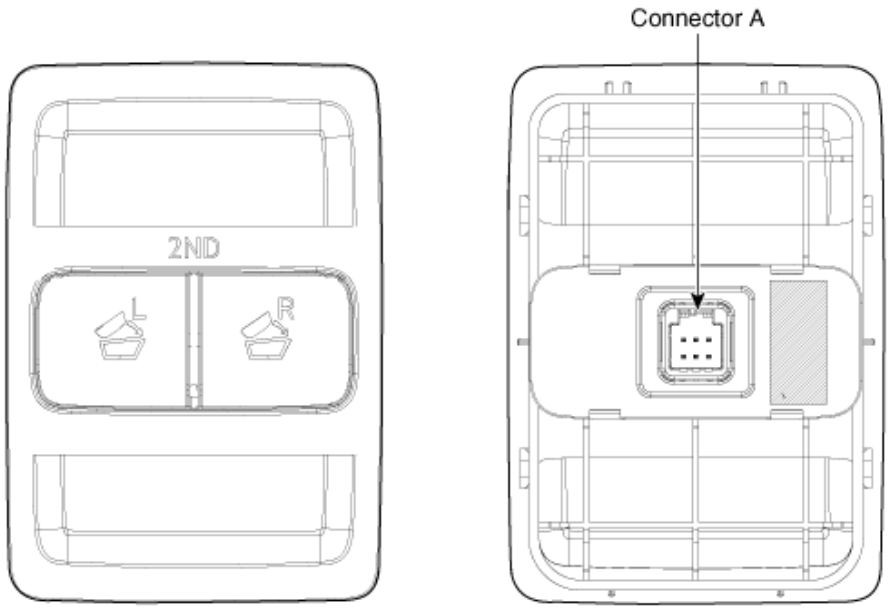
- Circuit Diagram

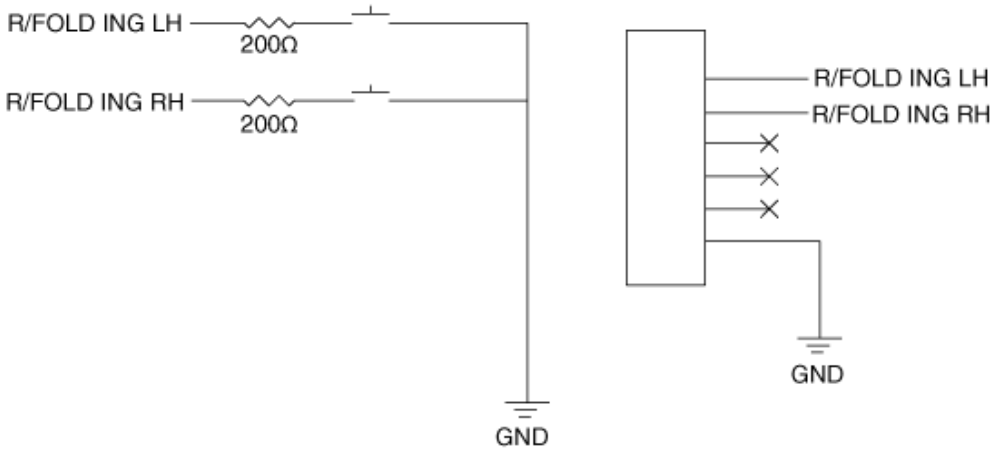
Left Swtich

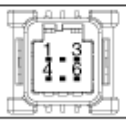


Connector A	Pin	Description	Pin	Description
	1	2nd folding (RH)	5	3rd unfolding (RH)
	2	Ground	6	3rd folding (RH)
	3	-	7	3rd folding (LH)
	4	2nd folding (LH)	9	3rd unfolding (LH)

Right Swtich



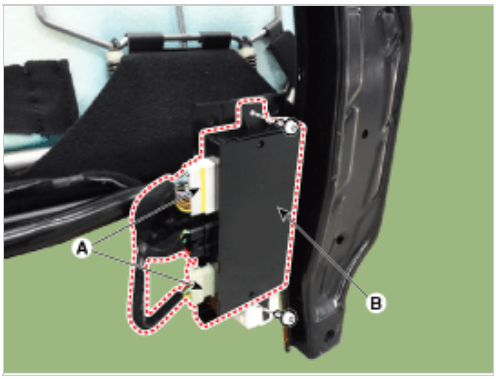


Connector A	Pin	Description	Pin	Description
	1	3rd folding (LH)	5	-
	2	3rd folding (RH)	6	-
	3	-	7	Ground

- Removal

Control Unit

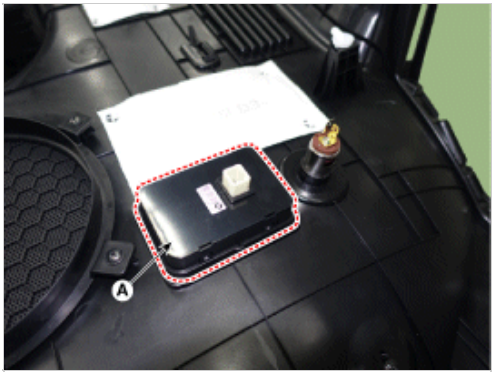
1. Remove the 3rt line seat assembly.
   (Refer to Body - "Rear Seat Assembly")
2. Remove the contorl unit (B) after disconnecting the connector (A).



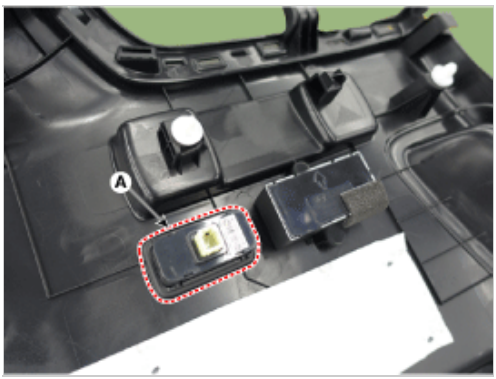
Switch

1. Remove the luggage side trim.
   (Refer to Body - "Luggage Side Trim")
2. Remove the seat folding switch (A).

[LH]



[RH]



- Installation

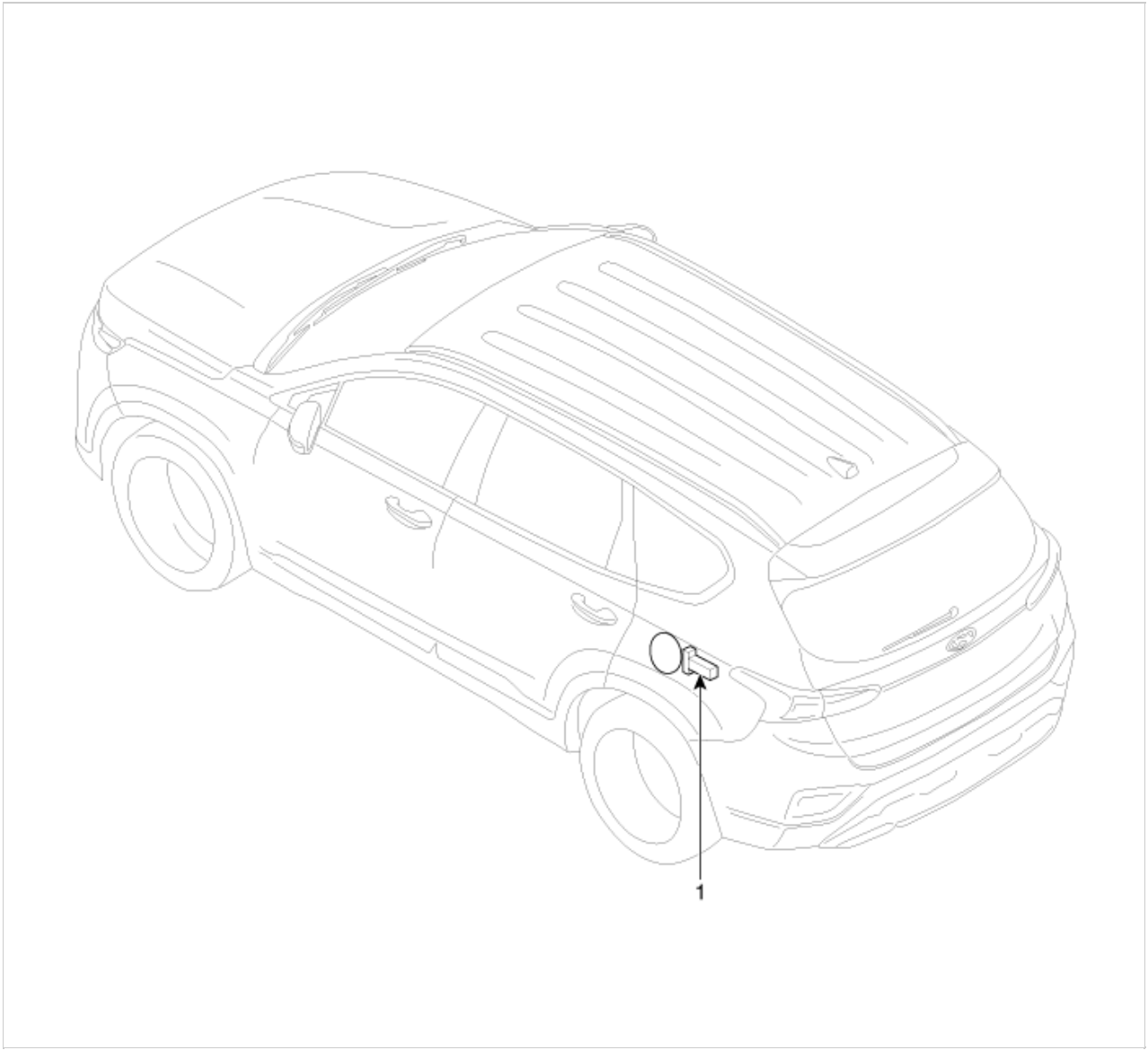
Control Unit

1. Install the control unit.
2. Install the 3rd line seat assembly.

Switch

1. Install the seat switch.
2. Install the luggage side trim.

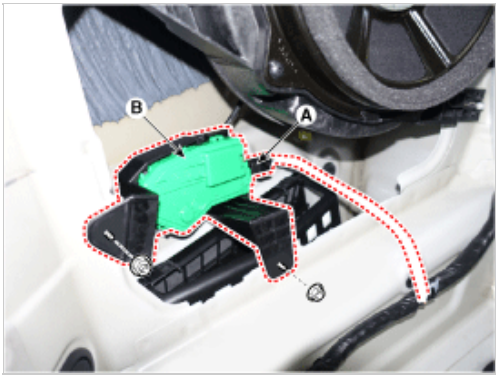
- Component Location



1. Fuel filler door release actuator

- Removal

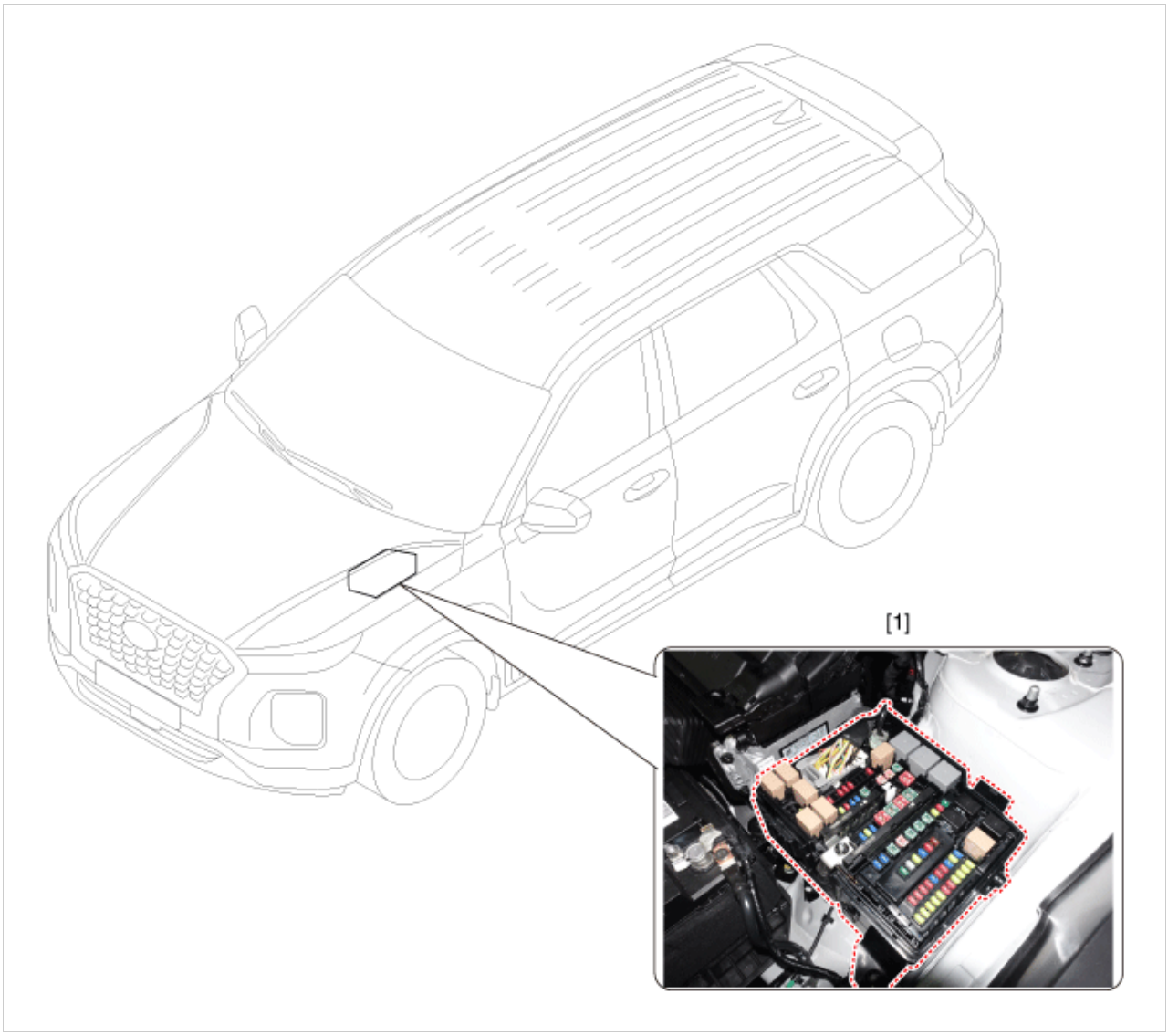
1. Remove the left luggage side trim.
   (Refer to Body - "Luggage Side Trim")
2. Disconnect the connector (A) and then remove the release actuator (B).



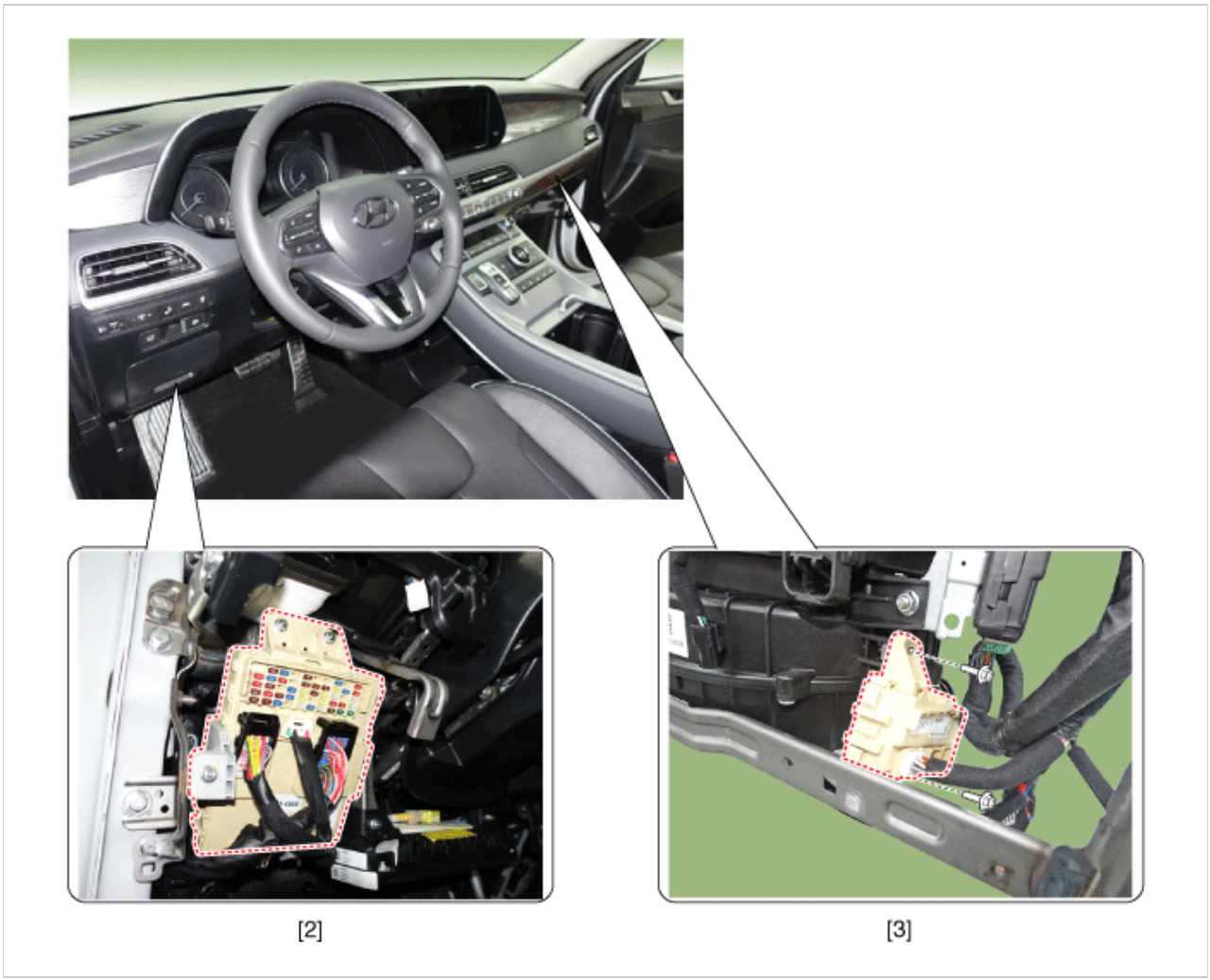
3. Disconnect the cable (A) and then remove the release actuator.

4. Check for continuity between terminal No. 1 and No. 2. If there is no continuity, replace the fuel filler door release actuator (A).

- Component Location



1. Engine room relay box



2. ICU Junction block

3. ICM relay box

- Inspection

1. Disconnect the negative (-) battery terminal.
2. Pull out the relay from the engine compartment relay box.

Power Relay (Type A)

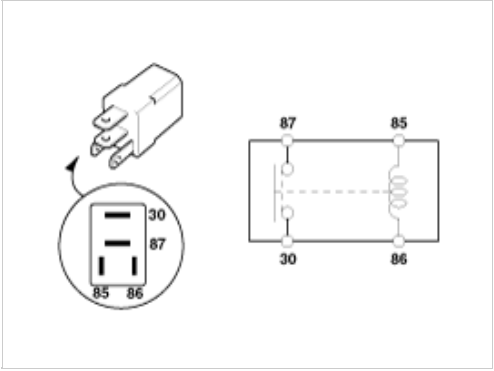
NOTICE

– Do not use pliers.
– Pliers will damage the relays, which could cause the engine to stall or not start.
– Carefully remove the relay using the relay puller.

Check for continuity between the terminals.

1. There should be continuity between the No.30 and No.87 terminals when power and ground are connected to the No.85 and No.86 terminals.
2. There should be no continuity between the No.30 and No.87 terminals when power is disconnected.

[Engine room relay box]

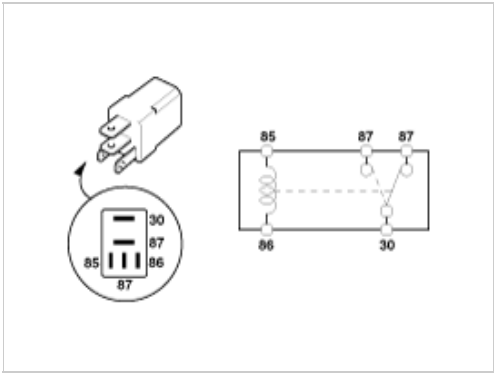


Terminal / Power	30	87	85	86
Disconnected			○	○
Connected	○	○	⊖	⊕

Power Relay (Type B)

Check for continuity between the terminals.
A : Wiper relay (Low)
B : Wiper relay (High)
C : Wiper Frt relay

1. There should be continuity between the No.30 and No.87 terminals when power and ground are connected to the No.85 and No.86 terminals.
2. There should be continuity between the No.30 and No.87 terminals when power is disconnected.

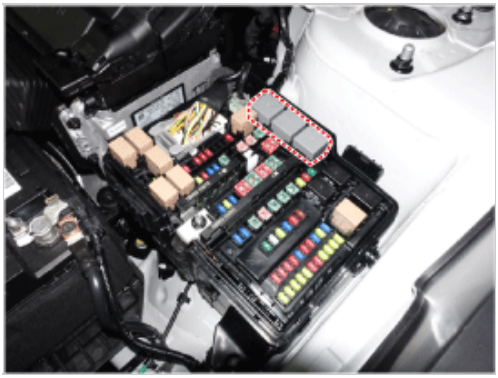


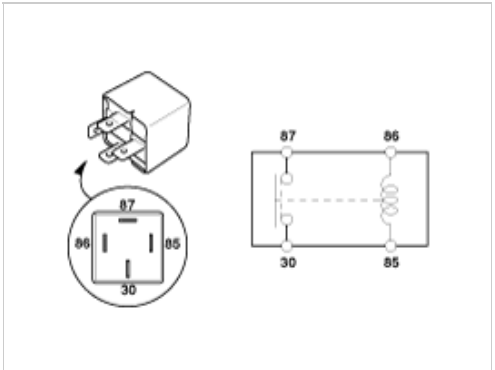
Terminal / Power	85	86	30	87	87a
Disconnected			○		○
Connected	⊖	⊕	○	○	

Power Relay (Type C)

Check for continuity between the terminals.
A : Cooling fan relay
B : Blower Frt relay
C : Rear heated relay

1. There should be continuity between the No.30 and No.87 terminals when power and ground are connected to the No.85 and No.86 terminals.
2. There should be no continuity between the No.30 and No.87 terminals when power is disconnected.





Terminal / Power	86	85	87	30
Disconnected	○	○		
Connected	⊖	⊕	○	○

Replacement of PCB Block

1. Disconnect the negative (-) battery terminal.
2. Push 4 hooks in the engine room relay box out to the arrow direction and put up the PCB block (A).

3. Disconnect the connector and remove the the PCB block (A).

Fuse

1. Be sure there is no play in the fuse holders, and that the fuses are held securely.
2. Are the fuse capacities for each circuit correct?
3. Are there any blown fuses?
   If a fuse is to be replaced, be sure to use a new fuse of the same capacity. Always determine why the fuse blew first and completely eliminate the problem before installing a new fuse.

Multi Fuse

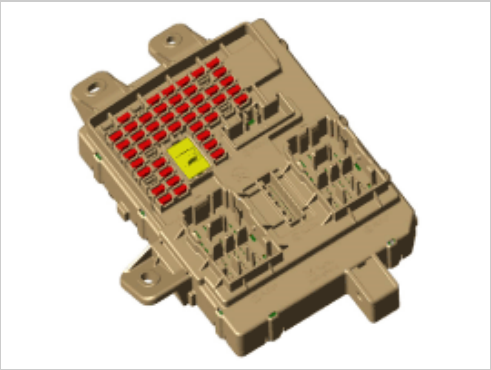
NOTICE

– Multi fuse (A) is needed to replace in the mass when it damaged only one fuse.
– When replace the multi fuse, refer to the "Engine compartment - component location" diagram exactly.
– Use the multi fuse capacities for each circuit correctly.

- Dscription and Operation

ICU (Integrated Central Control Unit)

ICU (Integrated Central Control Unit) is an integrated model of smart junction block and central gateway.
It performs the function of conventional "Smart junction block" and the function of communication medium of "Central Gateway".



Battery Monitoring System

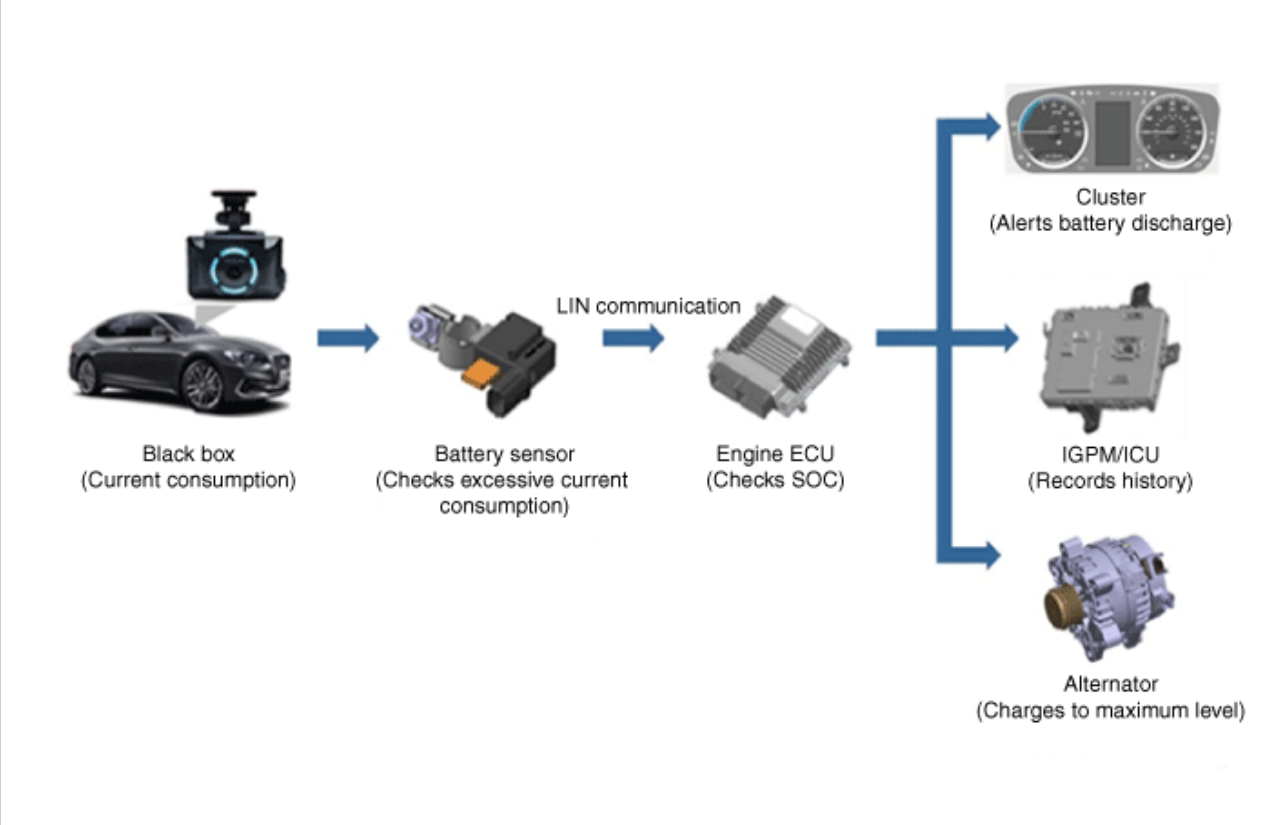
When the risk of battery discharge is detected due to excessive current consumption from using electrical device such as black box while the engine is OFF.

The system warns the customer of battery discharge through the warning message on the cluster.

The battery sensor detects the excessive current consumption of the battery and the Integrated Central control Unit (ICU) records the battery discharge history.

When the battery discharge is detected, the message warning the customer is displayed on the cluster and the battery is charged using the alternator when the engine is driven.

The recorded history can be checked via optional Diagnostic tool function: "Check the battery discharge warning history".



Checking the battery discharge warning history

– This function allows checking the history of excessive battery consumption of the parked vehicle.

– It is possible to check the running distance and SOC when the battery consumption was excessive and the current SOC information.

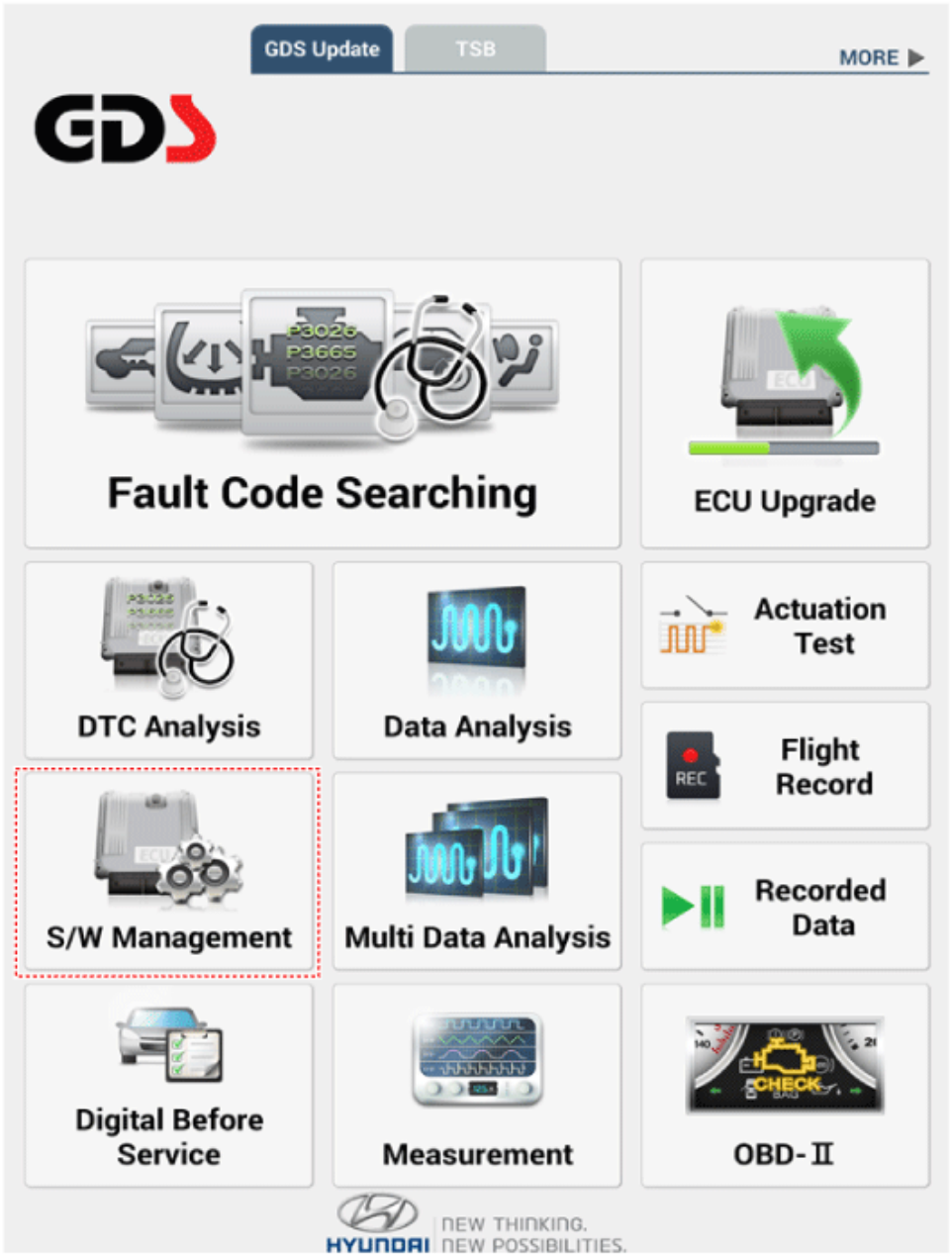
Using Diagnostic tool, the "Check the battery discharge warning history" function of ICU is implemented.

1. Procedure for coding variants

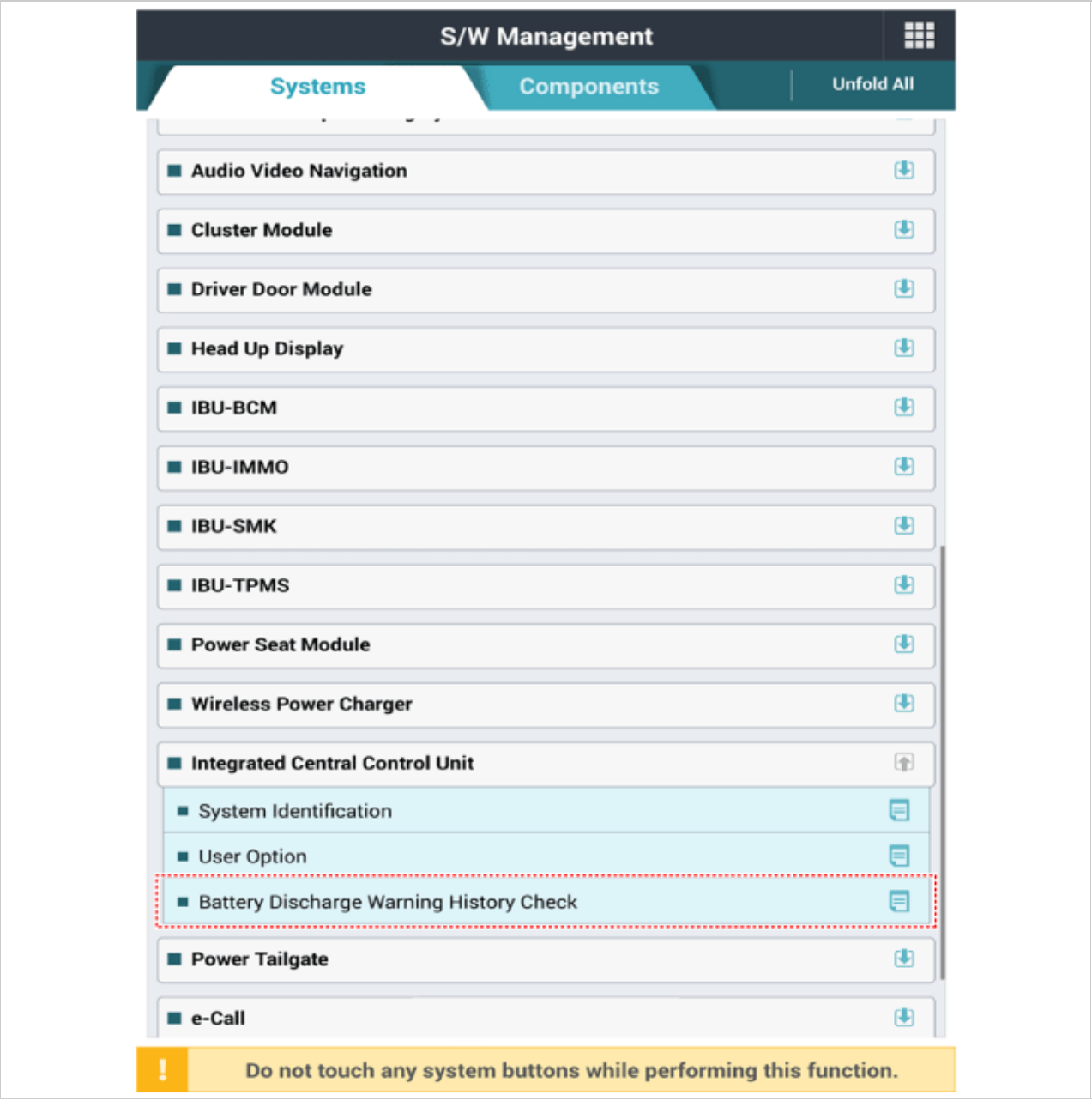
   (1) You should read the specification information for the front view camera that is installed in the vehicle before replacing it with a new front view camera.

   (2) Connect the cable of Diagnostic tool to the data link connector in driver side crash pad lower panel, and turn on the Diagnostic tool.

   (3) Select the 'S/W Management' and 'Car model'.



(4) Select the "Integrated Central Control Unit" and "Battery Discharge Warning History Check".



- Fuse Inspection

1. Check that the fuse holders are loosely held and that the fuses are securely fixed by the holders.
2. Check that each fuse circuit has the exact fuse capacity.
3. Check the fuses for any damage.

NOTICE

- If a fuse is to be replaced, be sure to use a new fuse of the same capacity. Always identify the cause of the blown fuse and completely eliminate the problem before installing a new fuse.

Diagnosis with Diagnostic tool

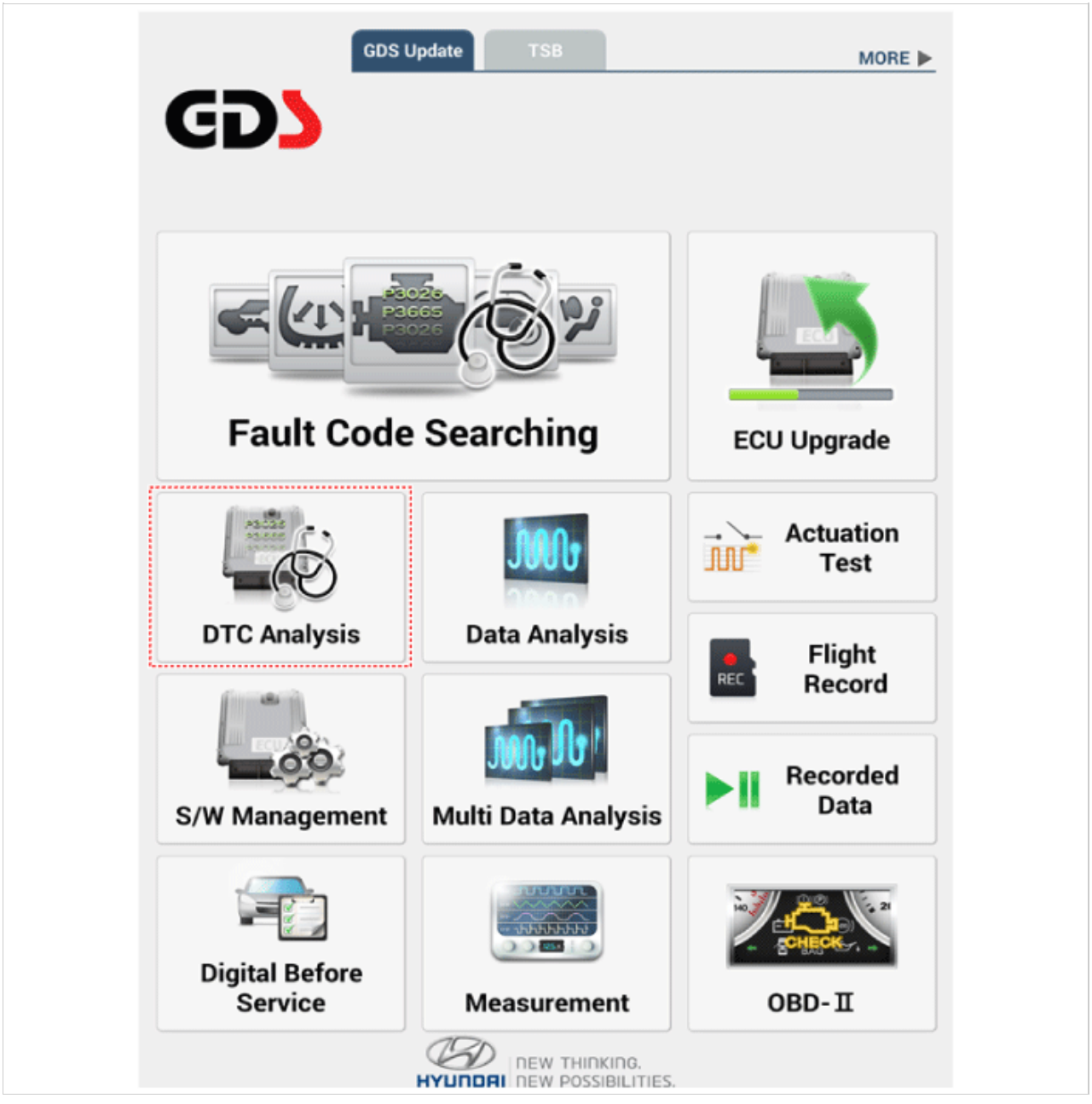
1. In the body electrical system, failure can be quickly diagnosed by using the vehicle diagnostic system (Diagnostic tool).
   The diagnostic system(Diagnostic tool) provides the following information.
   (1) The diagnostic system(Diagnostic tool) provides the following information.

(2) Data Analysis : Checking the system input/output data state

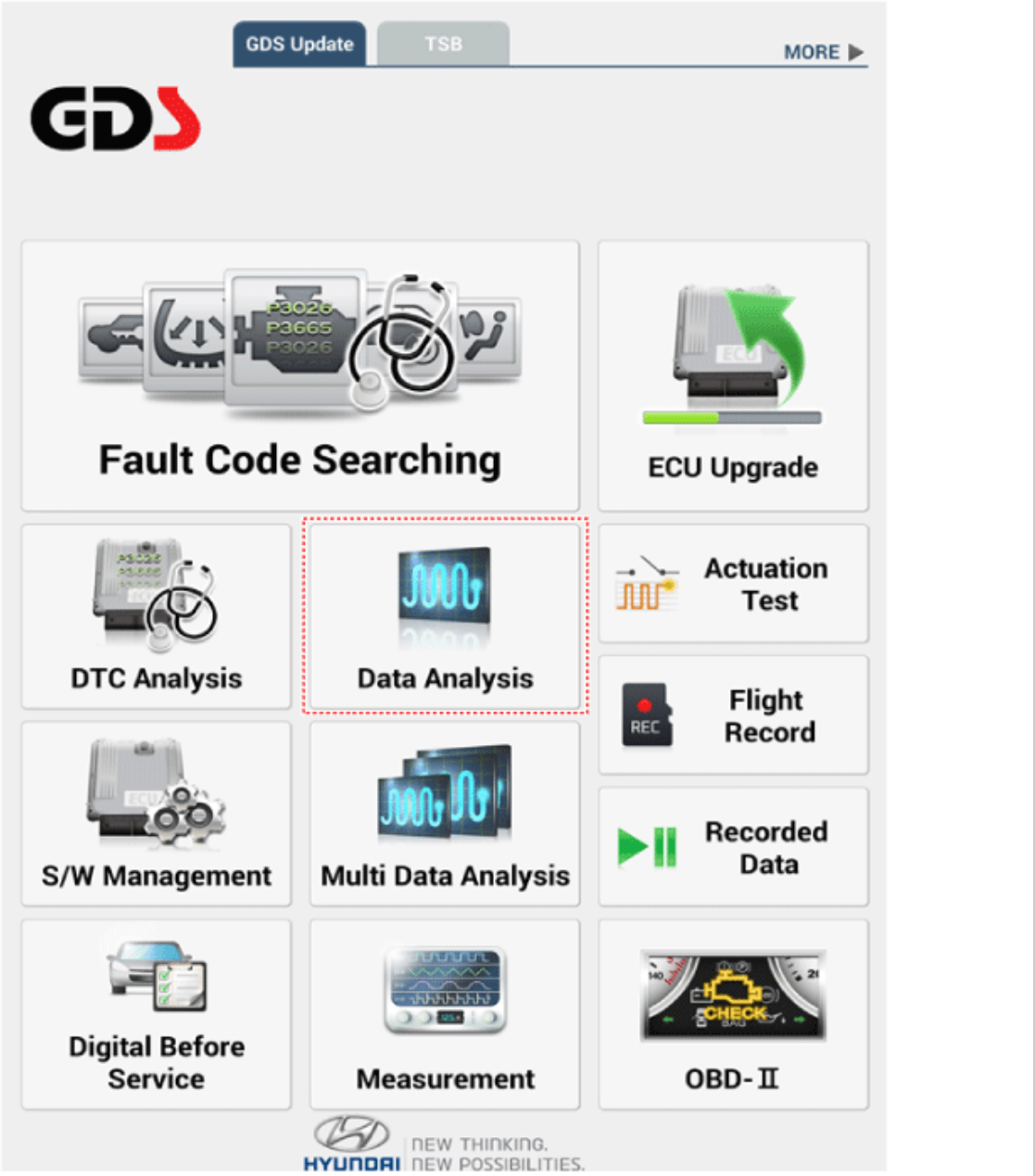
(3) Actuation test : Checking the system operation condition

(4) S/W Management : Controlling other features including system option setting and zero point adjustment

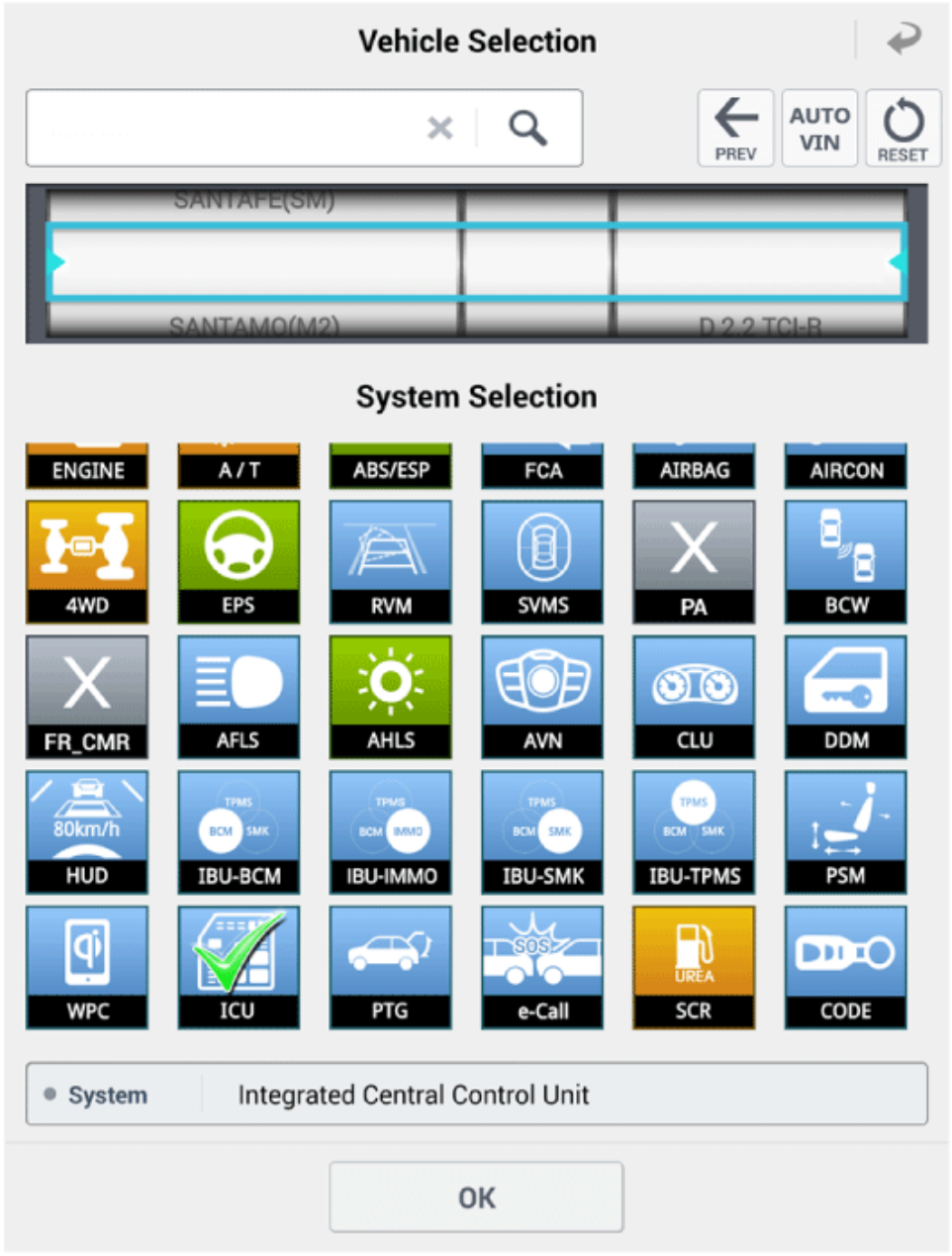
2. If diagnose the vehicle by Diagnostic tool, select "DTC Analysis" and "Vehicle".

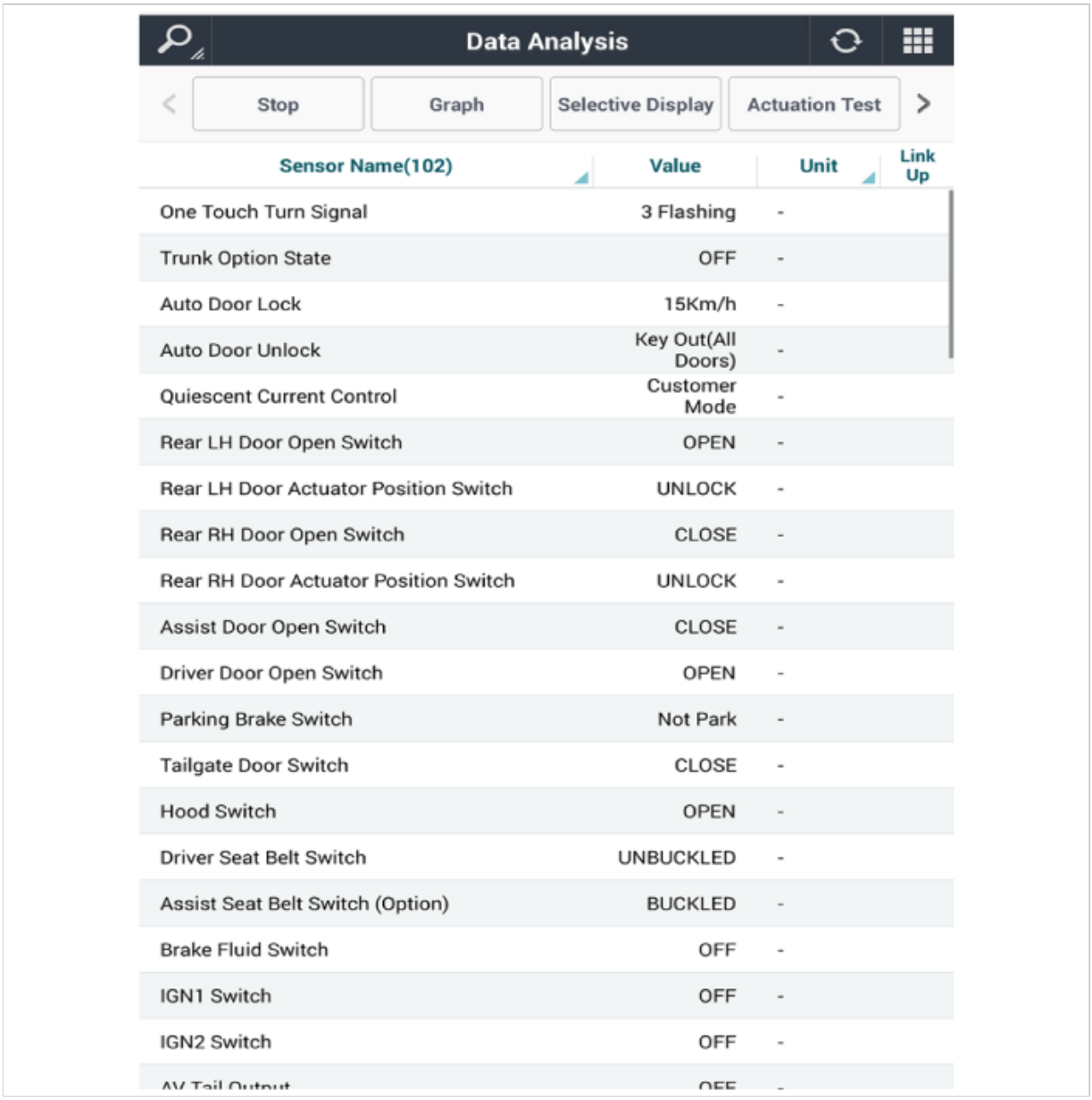


3. If check current status, select the "Data Analysis" and "Car model".



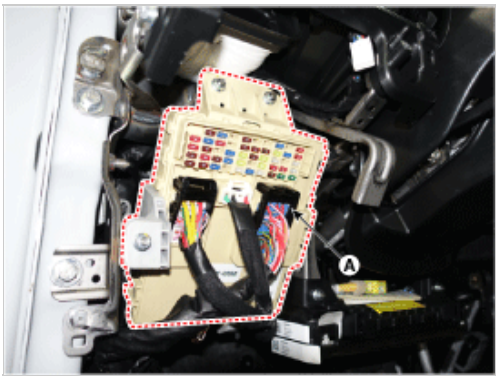
4. Select the 'ICU' to search the current state of the input/output data.


Vehicle Selection
PREV
AUTO VIN
RESET
SANTAFE(SM)
SANTAMO(M2)
D 2.2 TCI-R
System Selection
ENGINE
A / T
ABS/ESP
FCA
AIRBAG
AIRCON
4WD
EPS
RVM
SVMS
PA
BCW
FR_CMR
AFLS
AHLS
AVN
CLU
DDM
80km/h
HUD
IBU-BCM
IBU-IMMO
IBU-SMK
IBU-TPMS
PSM
WPC
ICU
PTG
e-Call
SCR
CODE
System
Integrated Central Control Unit
OK



- Removal

1. Disconnect the negative (-) battery terminal.
2. Remove the crash pad lower panel.
   (Refer to Body - "Crash Pad Lower Panel")
3. Disconnect the connectors from the fuse side of the ICU.
4. Remove the ICU (A) after loosening the mounting nuts.



5. Disconnect the connectors from the back side of the ICU.

- Installation

1. Install the ICU.
2. Install the crash pad lower panel.
3. Connect the negative (-) battery terminal.
4. Check that all system operates normally.

Body Electrical System

- Description

The ICM relay is united with (rear wiper relay, seat heater relay(front/rear), head lamp washer relay and rear A/C relay) which installed inside the lower crash pad.

Body Electrical System

- Inspection

Power Child Lock

Check for continuity between the terminals.

1. There should be continuity between the No.15 and No.7 terminals when power and ground are connected to the No.15 and No.14 in the ICM-A.
2. There should be continuity between the No.10 and No.12 terminals when power and ground are connected to the No.15 and No.14 in the ICM-A.

Power Child Unlock

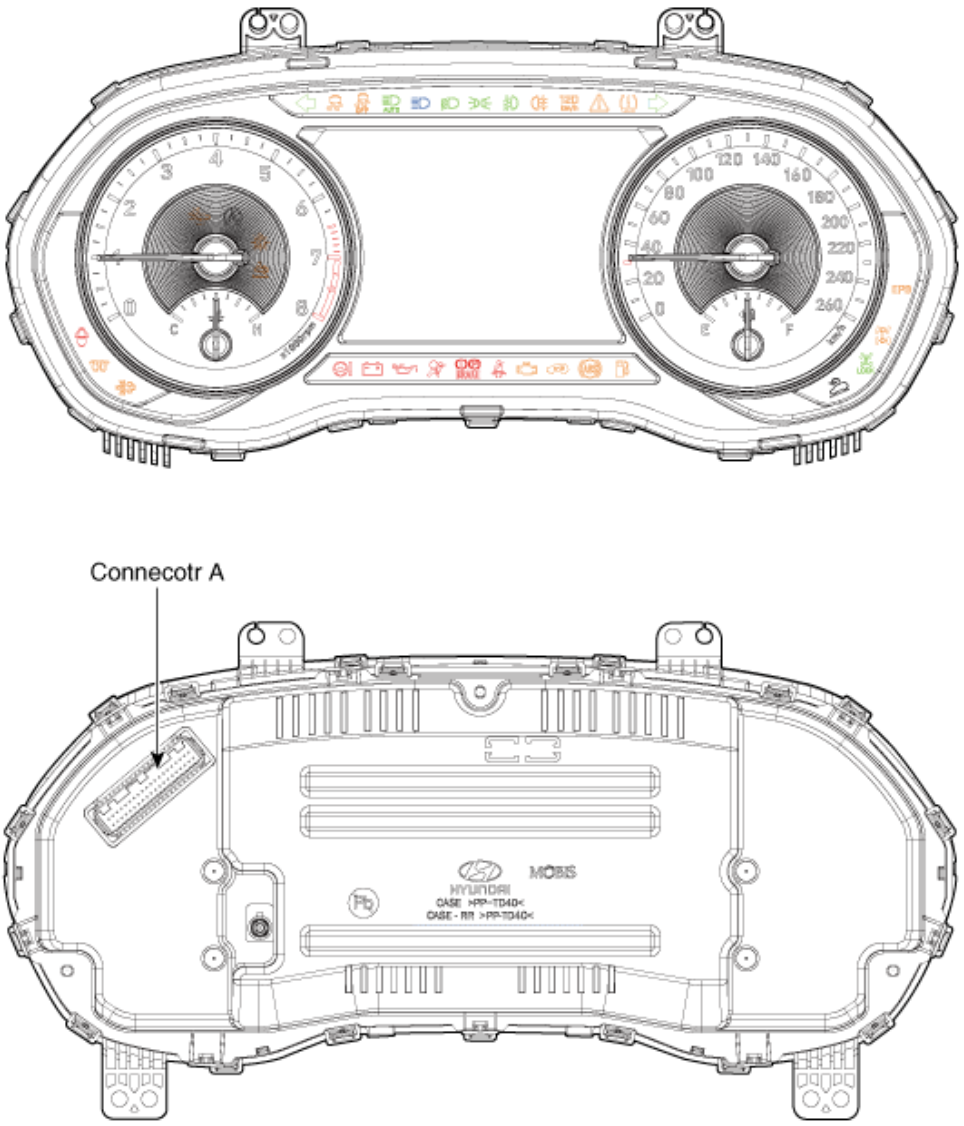
Check for continuity between the terminals.

1. There should be continuity between the No.11 and No.12 terminals when power and ground are connected to the No.11 and No.1 in the ICM-A.
2. There should be continuity between the No.10 and No.7 terminals when power and ground are connected to the No.11 and No.1 in the ICM-A.

- Components

3.5 Inch MONO LCD

7 Inch TFT LCD



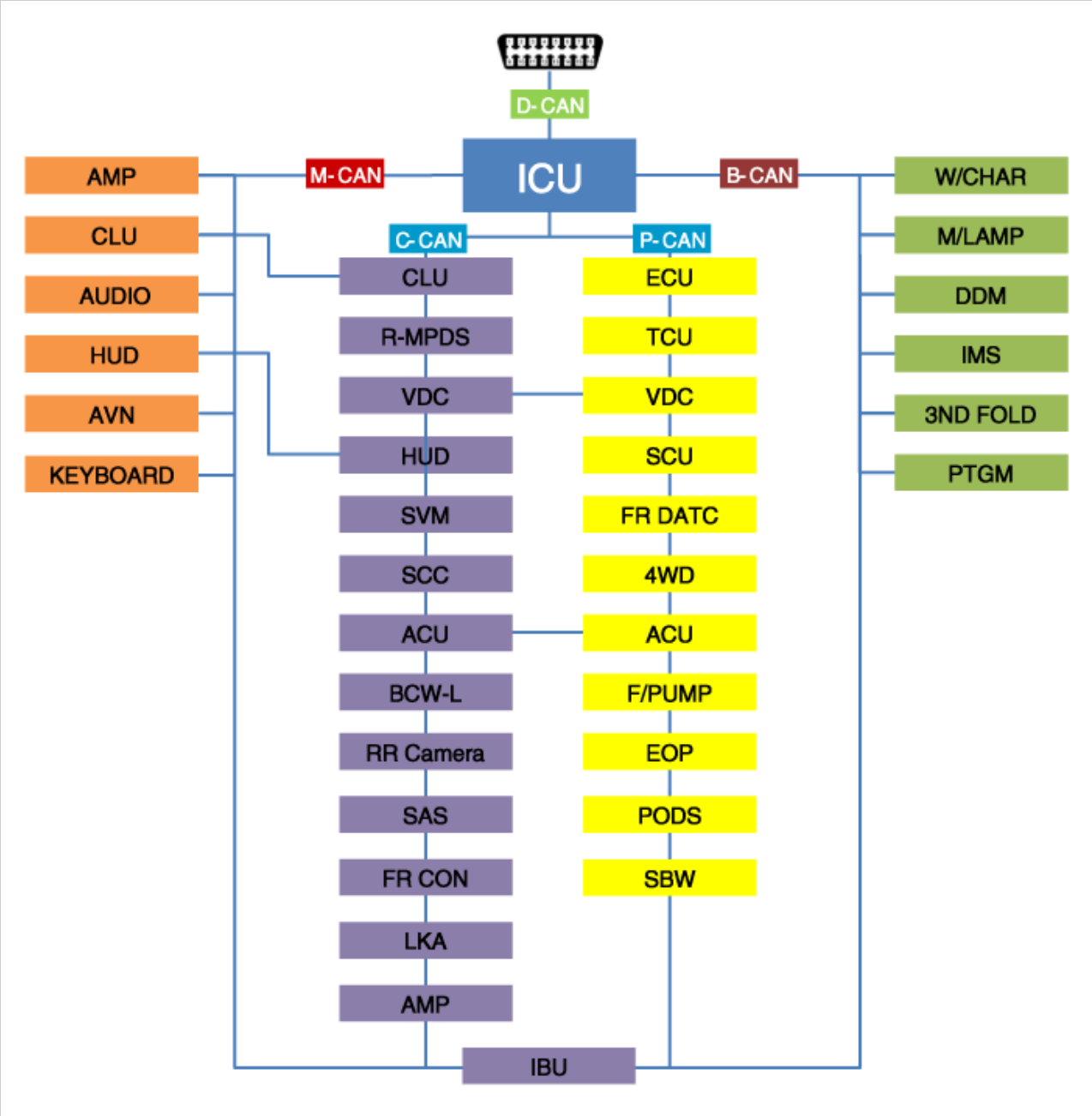
Connector Pin Information

No	Connector A	No	Connector B
1	Ground	21	Trip switch (-)
2	Illumination (-)	22	Trip switch 1 (+)
3	Rheostat switch (Down)_Input	23	Trip switch 2 (+)
4	Rheostat switch (Up)_Input	24	Active ECO_input switch/ R switch(M/T)_input
5	Dentent	25	Driver mode switch/ N switch(M/T)_input
6	-	26	Speaker1 (+)_Output
7	-	27	Speaker1 (-)_Output
8	-	28	-
9	-	29	B-CAN (Low)
10	-	30	B-CAN (High)
11	-	31	Engine Run State_Output
12	Vehicle speed_Output	32	C-CAN (High)
13	Alternator_Input	33	C-CAN (Low)
14	Fuel sender (+)_Input	34	Temperature_Input
15	-	35	-
16	Fuel sender (-)_Input	36	Steering wheel heater indicator

17	Water separate_Input	37	Ground
18	Airbag (+)_Input	38	-
19	Oil press switch (-)_Input	39	IGN 1
20	-	40	Battery (+)

- Description

Communication Network Diagram



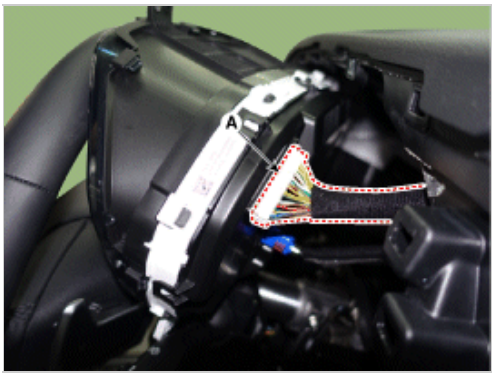
Abbreviation	Explanation
IBU	Interated Body Control Unit
DDM	Driver Door Module
PTGM	Power Tail Gate Module
ICU	Interated Control Unit
ECU	Engine Control Unit
CLU	Cluster

MDPS	Moter Driven Power Steering
SVM	Sorround View Monitor
ACU	Airbag Control Unit
VDC	Vehicle Dynamic Control
SCC	Smart Cruise Control
LKA	Lane Keeping Assist
BCW	Blind-Spot Collision Warning
SAS	Steering Angle Sensor
HUD	Head up Display
TCU	Transmission Control Unit
FR DATC	Dual Automatic Temp Control
4WD	Four Wheel Drive
F/PUMP	Fuel Pump Control Module
POCS	Passenger Occupant Classification System
IMS	Integrated Memory System
AMP	Amplifier
AVN	Head Unit (Audio / AVN)
HUD	Head Up Display
RR CAMERA	Rrar View Camera
FR CON	Front Console Switch
EOP	Electric Oil Pump
SBW	Shift BY Wire
W/CHAR	Wireless Power Chager
FR M/LP	Front Mood Lamp
3ND FOLD	3ND Seat Folding Control Unit
AUDIO	Audio unit
KEY BOARD	Center Fascia Keyboard

- Removal

1. Disconnect the negative (-) battery terminal.
2. Remove the cluster fascia panel (A).
   (Refer to Body - "Cluster Fascia Panel")
3. Remove the cluster (A) from the housing after removing screws.

4. Disconnect the cluster connecter (A) and then remove the cluster.

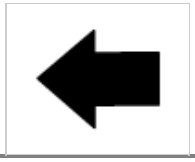
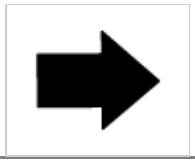
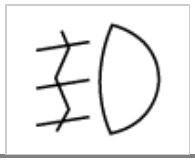
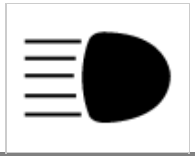
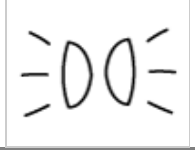


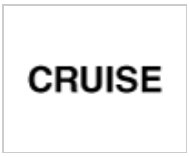
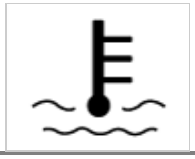
- Installation

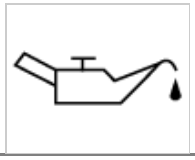
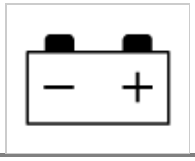
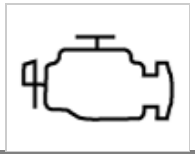
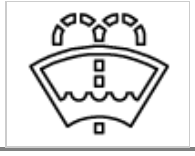
1. Connect the cluster connector.
2. Install the cluster assembly.
3. Install the cluster facia panel.
4. Connect the negative (-) battery terminal.

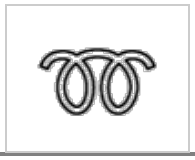
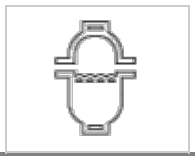
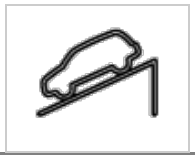
- Inspection

1. Check point (Warning indicator)

No	Ref Symbol	Color	Name	Signal Input	Signal Control (Unit / Sensor)	Check Point
1		Green	Turn Left	C-CAN	BCM	1) CAN line failure
2		Green	Turn Right	C-CAN		
3		Green	Front Fog	C-CAN	BCM	1) CAN line failure
4		Blue	High Beam	C-CAN	BCM	1) CAN line failure
5		Green	Low Beam	C-CAN	BCM	1) CAN Line failure
6		Green	Tail Lamp	C-CAN	BCM	1) CAN Line failure

7		Green	Cruise	C-CAN	EMS	1) CAN line failure
8		Green	SET	C-CAN	EMS	1) CAN line failure
9		Red	Seat Belt	C-CAN	BCM	1) CAN line failure
10		Red	Air Bag	C-CAN	ACU	1) CAN line failure
11		Yellow	Trunk Open	C-CAN	BCM	1) CAN line failure
12		Red	Door Open	C-CAN	BCM	1) CAN line failure
13		Red	High Temperature	C-CAN	EMS	1) CAN line failure
14		Yellow	Immobilizer	C-CAN	SMK	1) CAN line failure
15		Yellow	ABS	C-CAN	ESC	1) CAN line failure
16		Yellow	EPB	C-CAN	EPB	1) CAN line failure
17		Yellow	ESC	C-CAN	ESC	1) CAN line failure
18		Yellow	ESC OFF	C-CAN	ESC	1) CAN line failure

19		Yellow	TPMS (Tread & Fail)	C-CAN	TPMS	1) CAN line failure
20		Yellow	Fuel Low	Hardwire	Fuel Sender	1) Fuel sender failure 2) Wiring failure
21		Red	Parking Brake	C-CAN	BCM TCS EPB	1) CAN line failure
22		Yellow	Oil Pressure	Hardwire	Oil Pressure Sensor	1) Wiring failure
23		Red	Battery Charge	Hardwire	Battery Sensor	1) Wiring failure
24		Yellow	Check Engine	C-CAN	EMS	1) CAN line failure
25		Yellow	Low Washer	Hardwire	Water Level Sensor	1) Wiring failure
26		Green	AUTOHOLD (Green)	C-CAN	ESC	1) CAN line failure
		Yellow	AUTOHOLD (Yellow)	C-CAN	ESC	1) CAN line failure
		White	AUTOHOLD (White)	C-CAN	ESC	1) CAN line failure
		Green				

27		White Yellow	LDWS	C-CAN	LDWS	1) CAN line failure
28		Green	Active ECO	Hardwire	ECO ON/OFF Switch	1) Switch failure 2) Wiring failure
29		Yellow	4WD Diagnosis	C-CAN	4WD Unit	1) 4WD unit failure 2) CAN line failure
30		Yellow	4WD LOCK	C-CAN	4WD ECU	1) 4WD ECU failure 2) CAN line failure
31		Yellow	Glow	C-CAN	Glow Plug	1) Glow plug failure 2) CAN line failure
32		Red	EPS	C-CAN	EPS Unit	1) EPS unit failure 2) CAN line failure
33		Red	Water Seperator	C-CAN	Fuel filter water seperator sensor	1) Water seperator sensor failure 2) CAN line failure
34		Green Yellow	DBC	C-CAN	TCU	1) TCU failure 2) CAN line failure

2. Check point (Gauge)

No	Name	Signal Input	Signal Control (Unit/Sensor)	Check Point
1	Speedometer	C-CAN	TCU, ABS	1) CAN Line failure
2	Tachometer	C-CAN	EMS	1) CAN Line failure
3	Cooling water temperature	C-CAN	EMS	1) CAN Line failure
4	Fuel	Hardwire	Fuel sender	1) Fuel sender failure 2) Wiring failure

3. Communication information

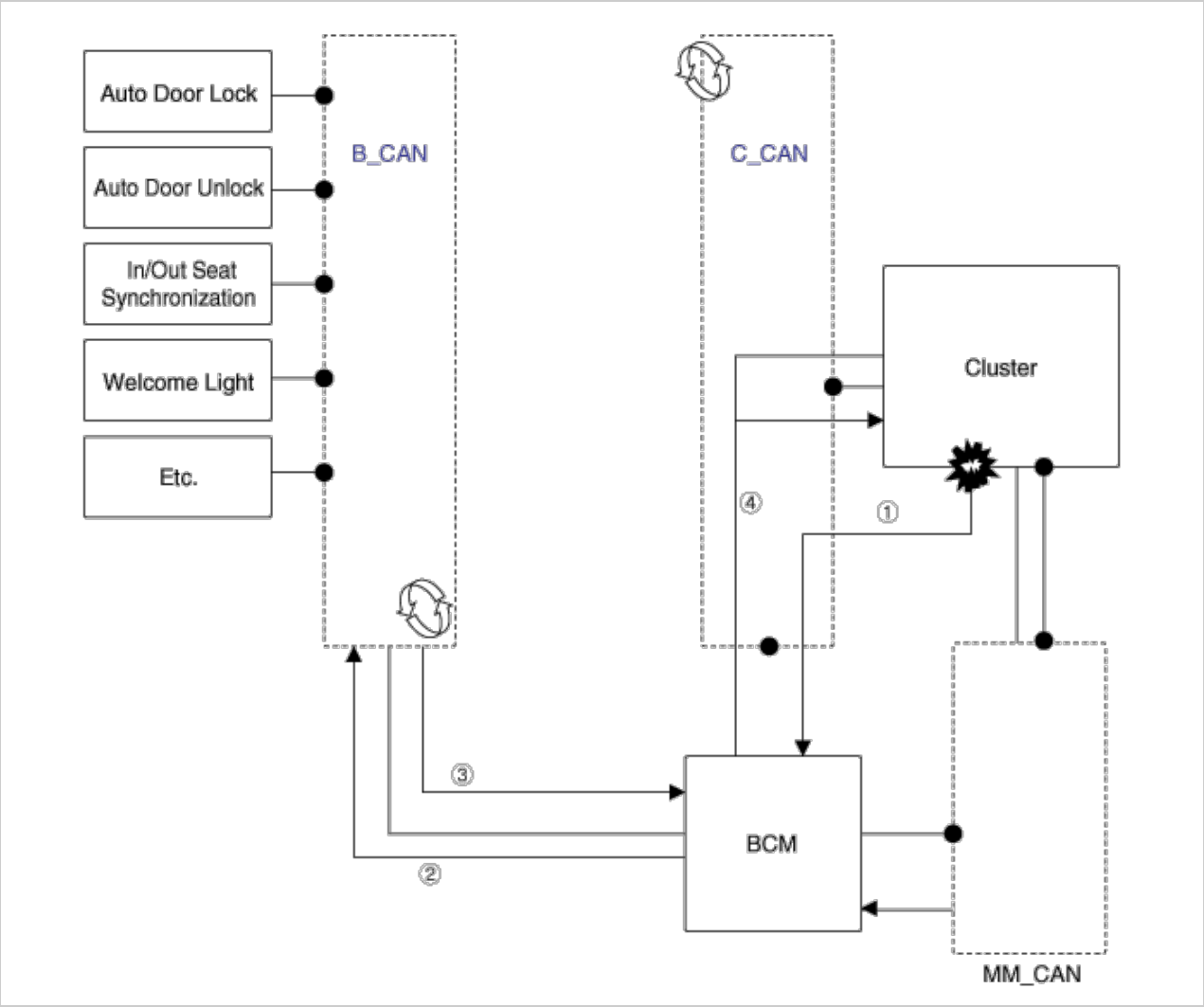
Transmision Unit	Receive Unit	CAN Communication	Reference
Cluster	BCM	C-CAN	Refuel detecede state
			Instant fuel consumption information
			Low fuel warning information

			Vehicle setting condition
			Illumination setting
Cluster	EMS	C-CAN MM-CAN	SPORT/ECO Mode
	TCU		
	ECS		
	ESP		
	AVN		
Cluster	SCC	C-CAN	Vehicle speed
Cluster	ACU	C-CAN	Airbag state
ACU	Cluster	CAN	Airbag warning indicator control
BCM	Cluster	CAN	Hood indicator display
DATC	Cluster	CAN	External temperature display
ECS	Cluster	CAN	Warning control
EMS	Cluster	CAN	Tachometer control
			Temperature guage control
			Check engine symbol, CRUISE and SET indicator control
EPB	Cluster	CAN	EPB indicator, Parking brake indicator control
			Sound control
ESC	Cluster	CAN	-
BCM	Cluster	CAN	Vehicle setting control
			Warnig indicator and warning sound, PAS control
LDWS	Cluster	CAN	LDWS warning indicator, massage display and steering angle display
SAS	Cluster	CAN	
SMK	Cluster	CAN	Smart key indicator display
TCS	Cluster	CAN	ESC OFF switch condition display
			SCC turn stop lamp on/off
			Warning indicator display
TCU	Cluster	CAN	AT gear information display
			Speed input
			SBW indicator
TPMS	Cluster	CAN	TPMS indicator

4. Other cluster check list

(1) UMS Setting Mode

There are items (for example Two Turn Unlock, Auto Door Dock/Unlock, In/Out Seat Synchronization, Door Lock Sound, Head Lamp Escrot, One Touch Triple Turn, Welcome Light, and Content Setup) that can be set and customized



(2) UMS Setting Procedure

1) Module setting

① UMS settings are sent to BCM →

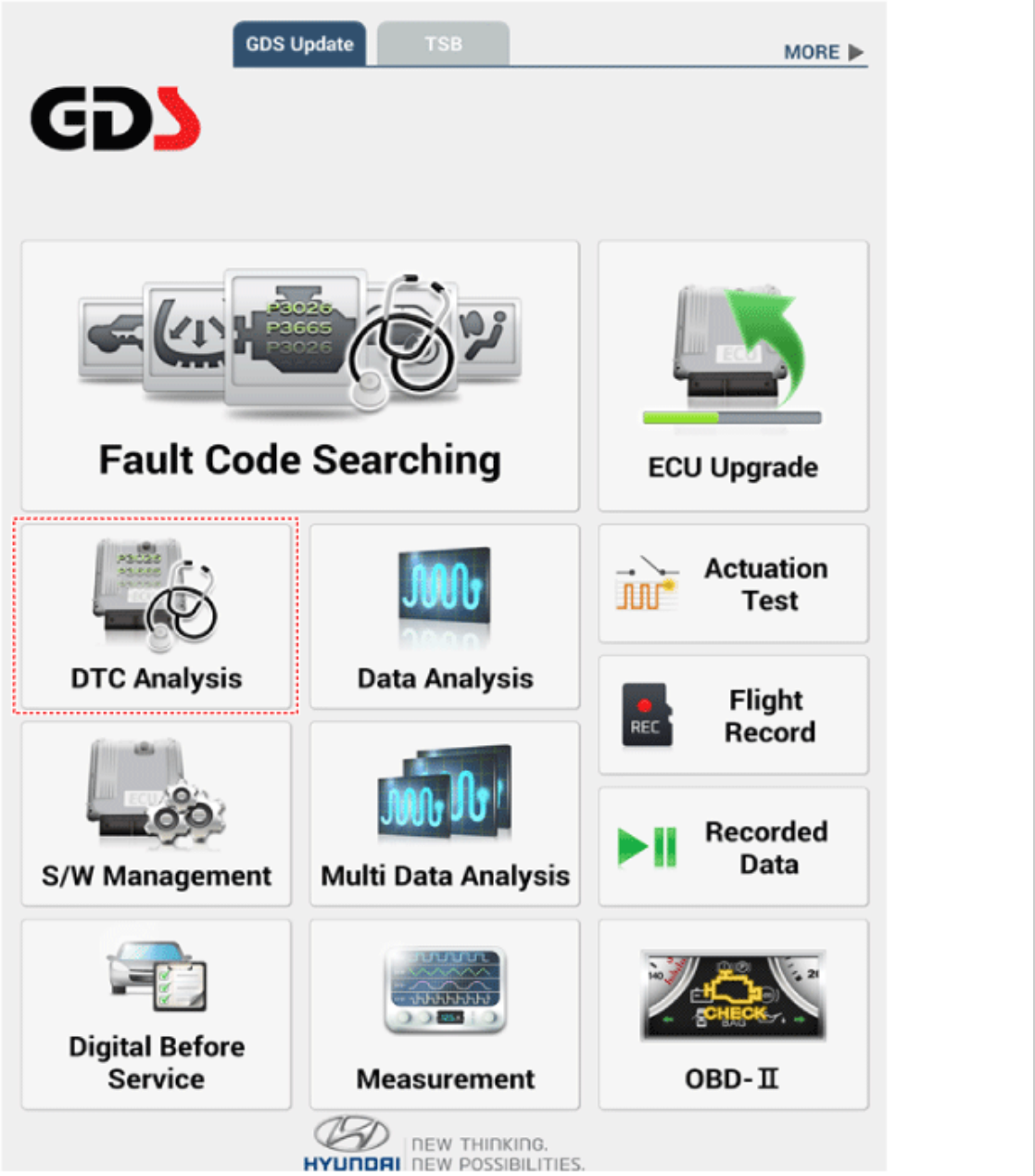
② Settings are sent via BCM B_CAN to the relevant module →

③ When the module setting is completed, the current settings are sent to BCM →

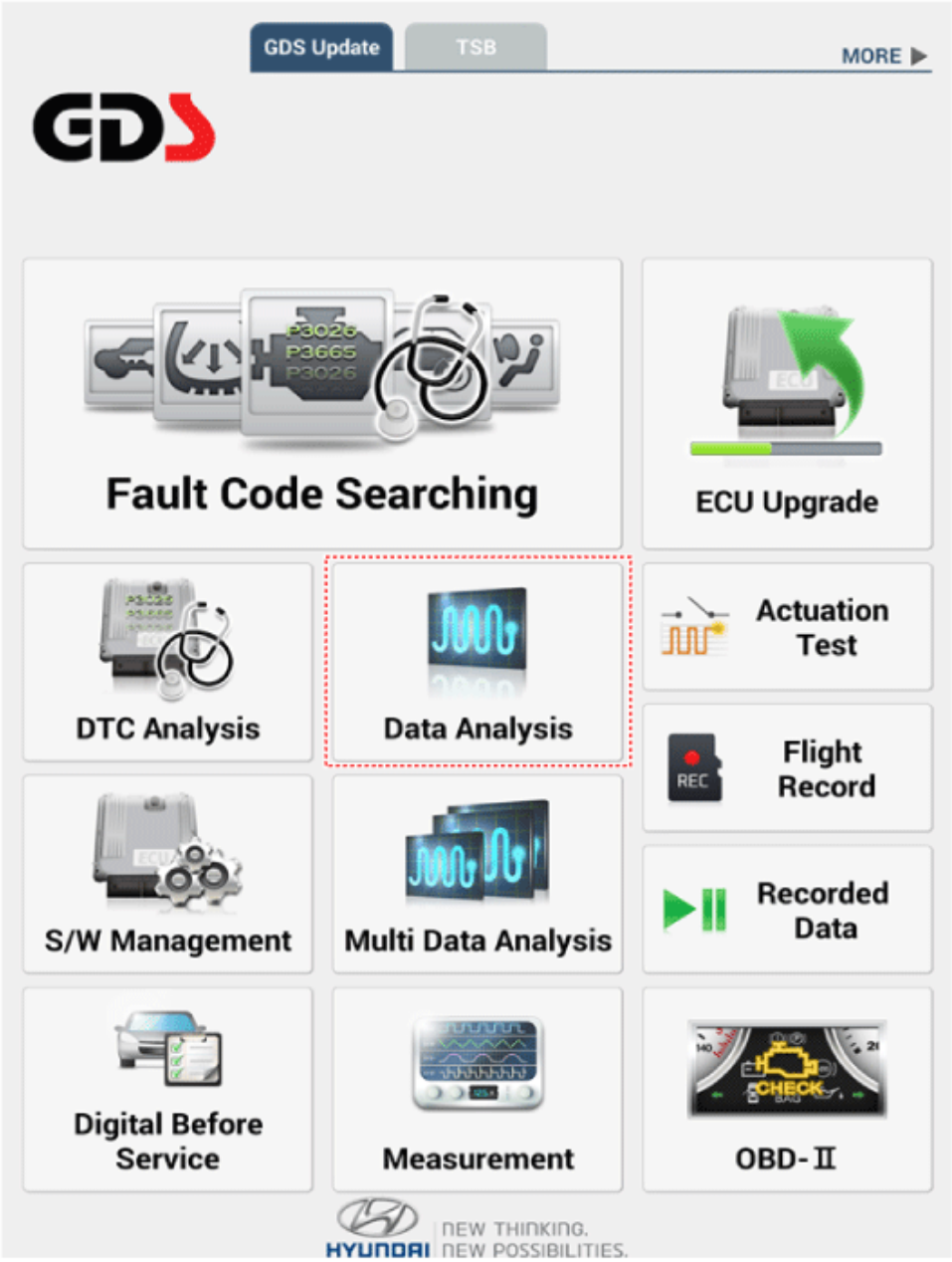
④ The final settings are sent via BCM C-CAN to the dashboard.

Diagnosis with Diagnostic tool

1. In the body electrical system, failure can be quickly diagnosed by using the vehicle diagnostic system (Diagnostic tool).
   The diagnostic system (Diagnostic tool) provides the following information.
   (1) Fault Code Searching : Checking failure and code number (DTC)
   (2) Data Analysis : Checking the system input/output data state
   (3) Actuation test : Checking the system operation condition
   (4) S/W Management : Controlling other features including system option setting and zero point adjustment
2. If diagnose the vehicle by Diagnostic tool, select "DTC Analysis" and "Vehicle".

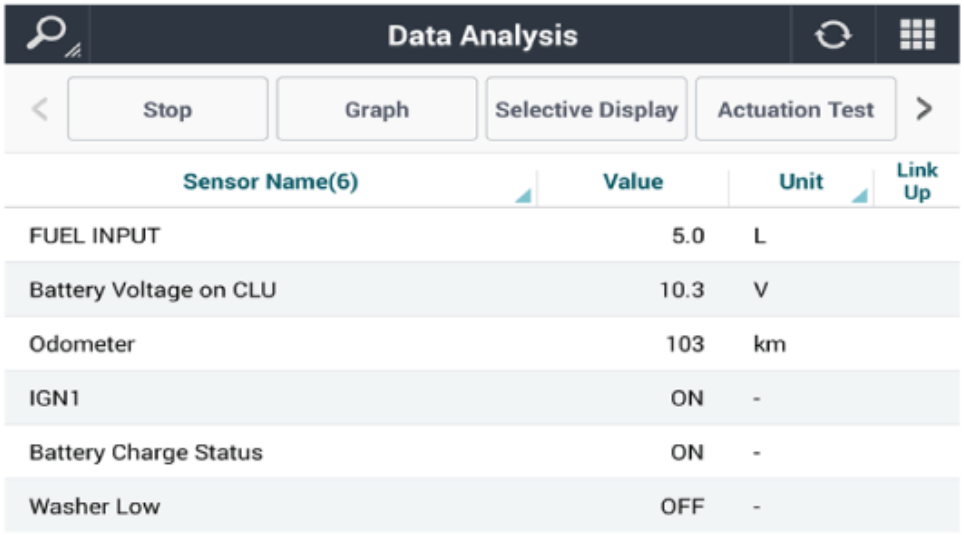


3. If check current status, select the "Data Analysis" and "Car model".



4. Select the 'CLU' to search the current state of the input/output data.

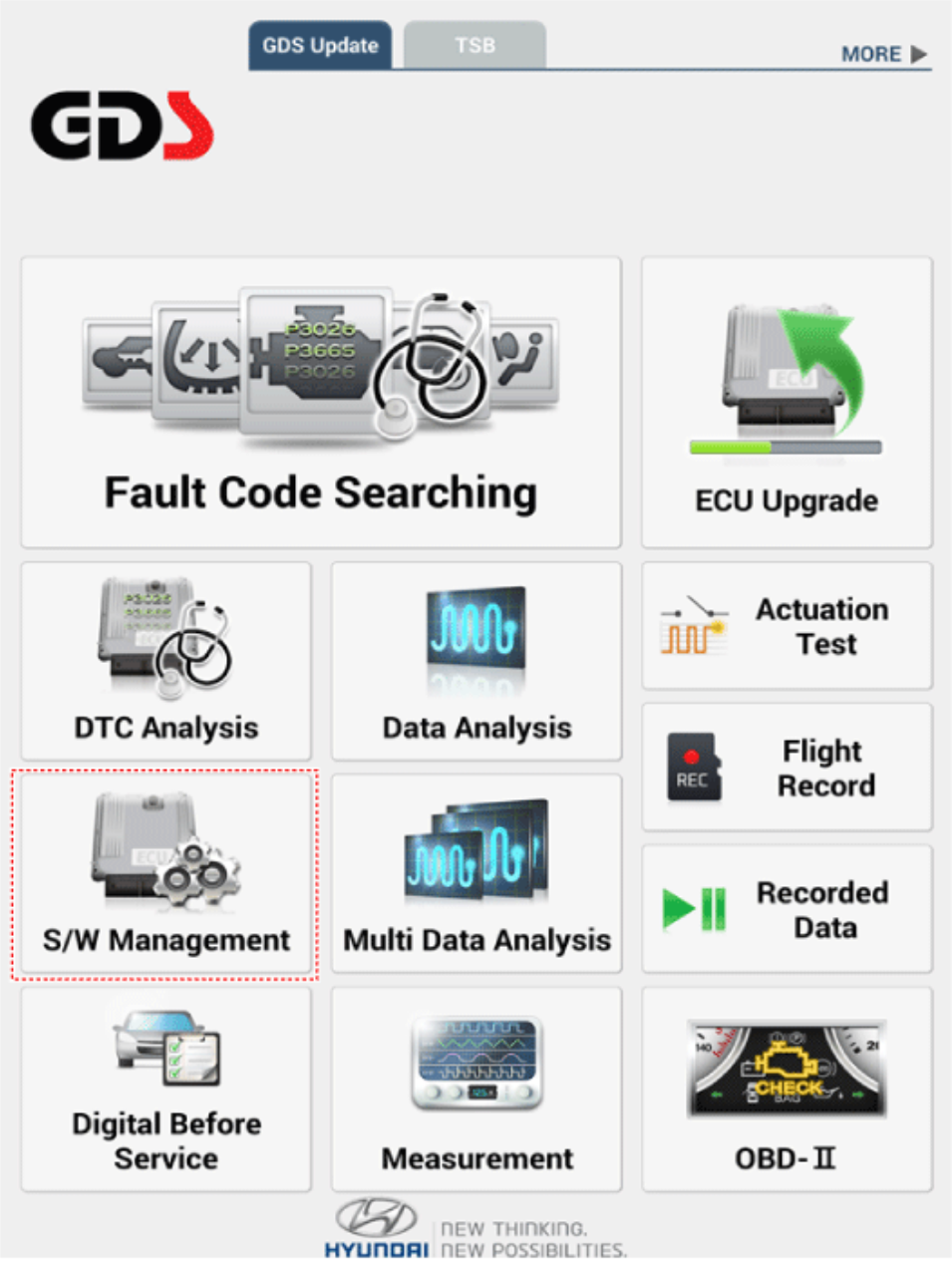
Vehicle Selection
PREV
AUTO VIN
RESET
SANTAFE(SM)
SANTAMO(M2)
D 2.2 TCI-R
System Selection
ENGINE
A / T
ABS/ESP
FCA
AIRBAG
AIRCON
4WD
EPS
RVM
SVMS
PA
BCW
FR_CMR
AFLS
AHLS
AVN
CLU
DDM
80km/h
HUD
IBU-BCM
IBU-IMMO
IBU-SMK
IBU-TPMS
PSM
System
Cluster Module
OK



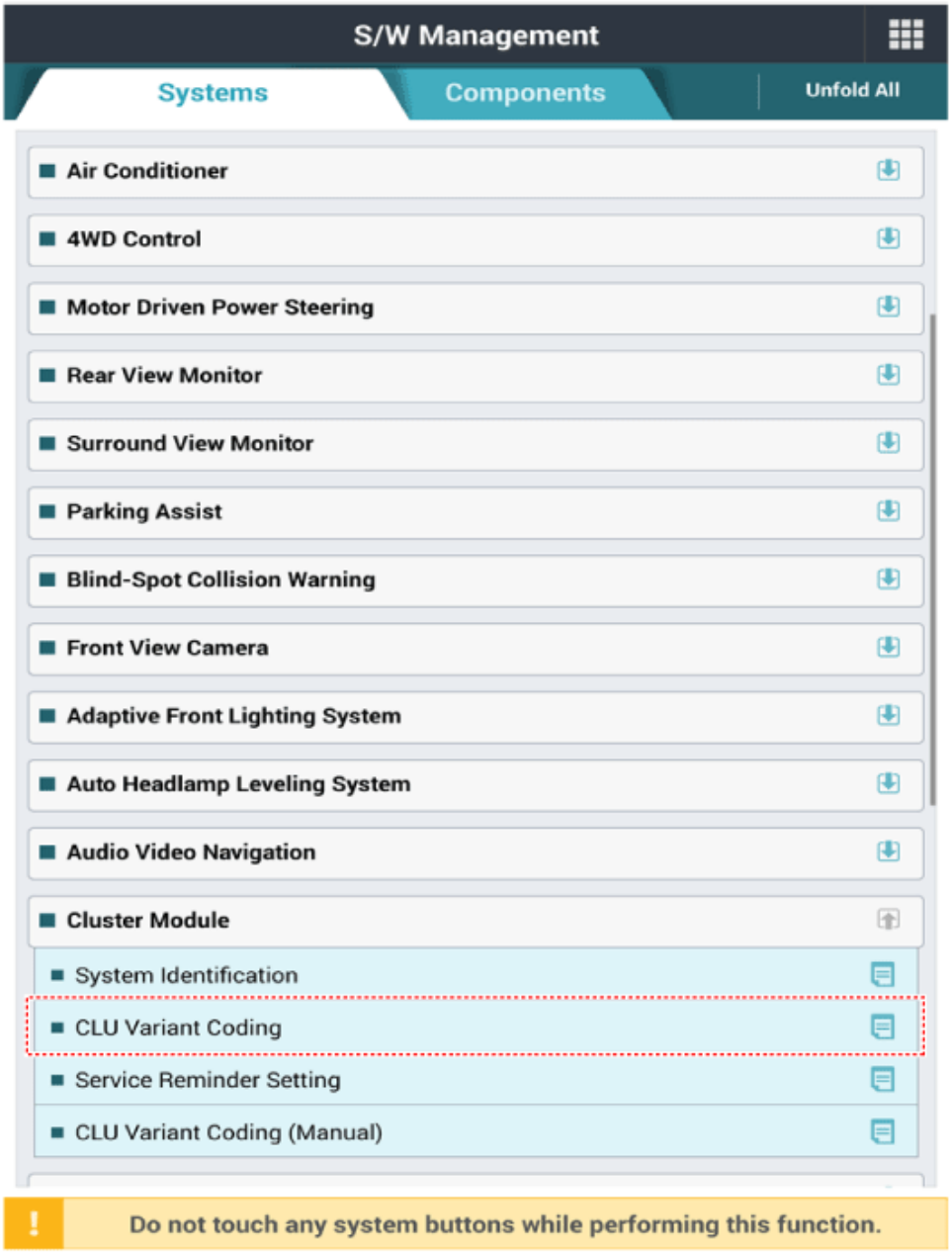
CLU Variant Coding

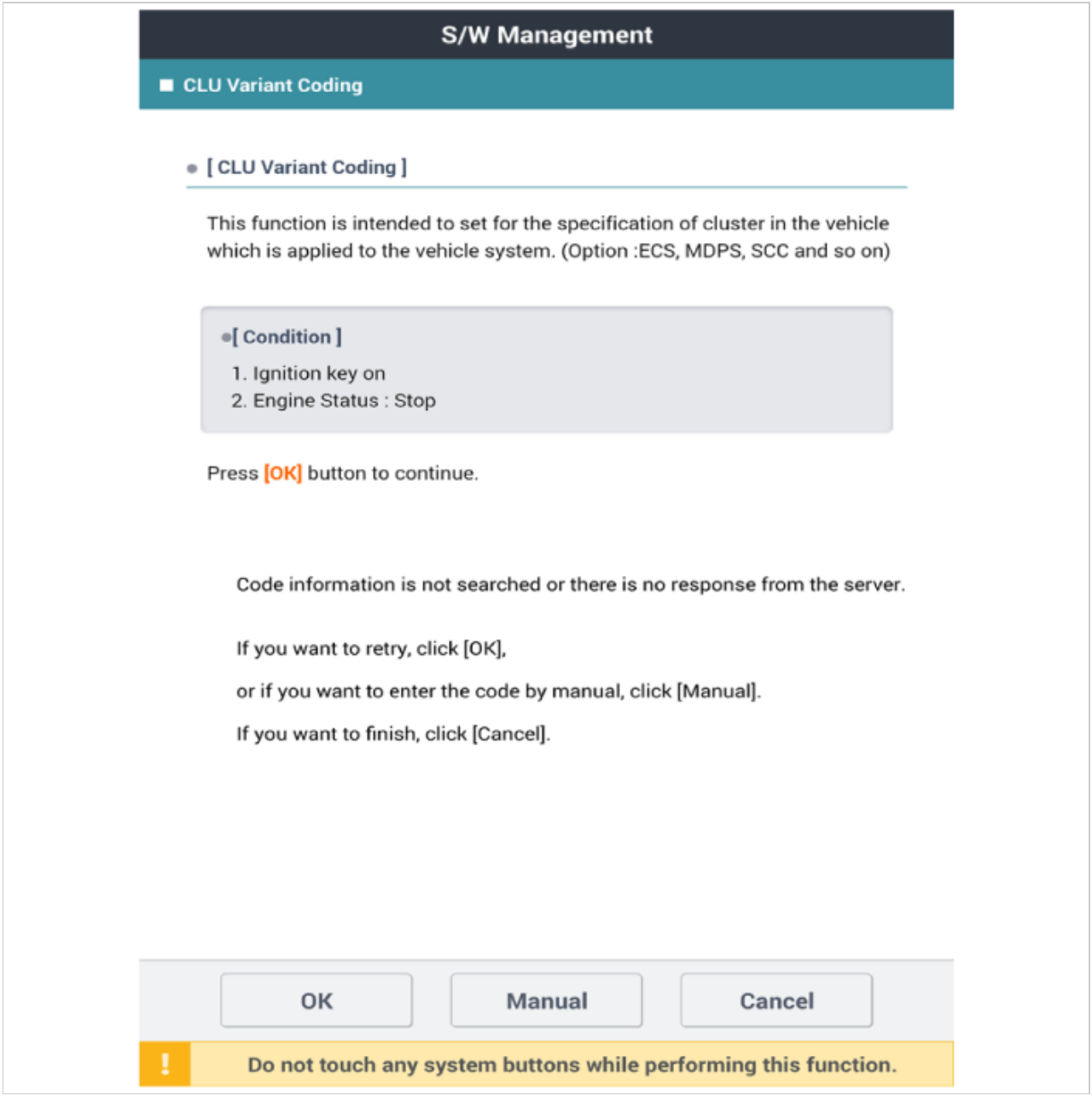
As we have more options (ESC, TPMS, SCC, etc.) in the car, the dashboard now have more information to display depending on the chosen options.
For this reason, we need to learn which options the current vehicle when we replace the dashboard.
To address this issue, a course of learning based on the option required for the vehicle when replacing the dashboard should be carried out.
This is called Variant Coding.

1. Connect the cable of Diagnostic tool to the data link connector in driver side crash pad lower panel.
2. Select the 'S/W Management' and 'Car model'.



3. Select the 'Cluster Module' and 'CLU Variant Coding'.


S/W Management
Systems
Components
Unfold All
Air Conditioner
4WD Control
Motor Driven Power Steering
Rear View Monitor
Surround View Monitor
Parking Assist
Blind-Spot Collision Warning
Front View Camera
Adaptive Front Lighting System
Auto Headlamp Leveling System
Audio Video Navigation
Cluster Module
System Identification
CLU Variant Coding
Service Reminder Setting
CLU Variant Coding (Manual)
Do not touch any system buttons while performing this function.

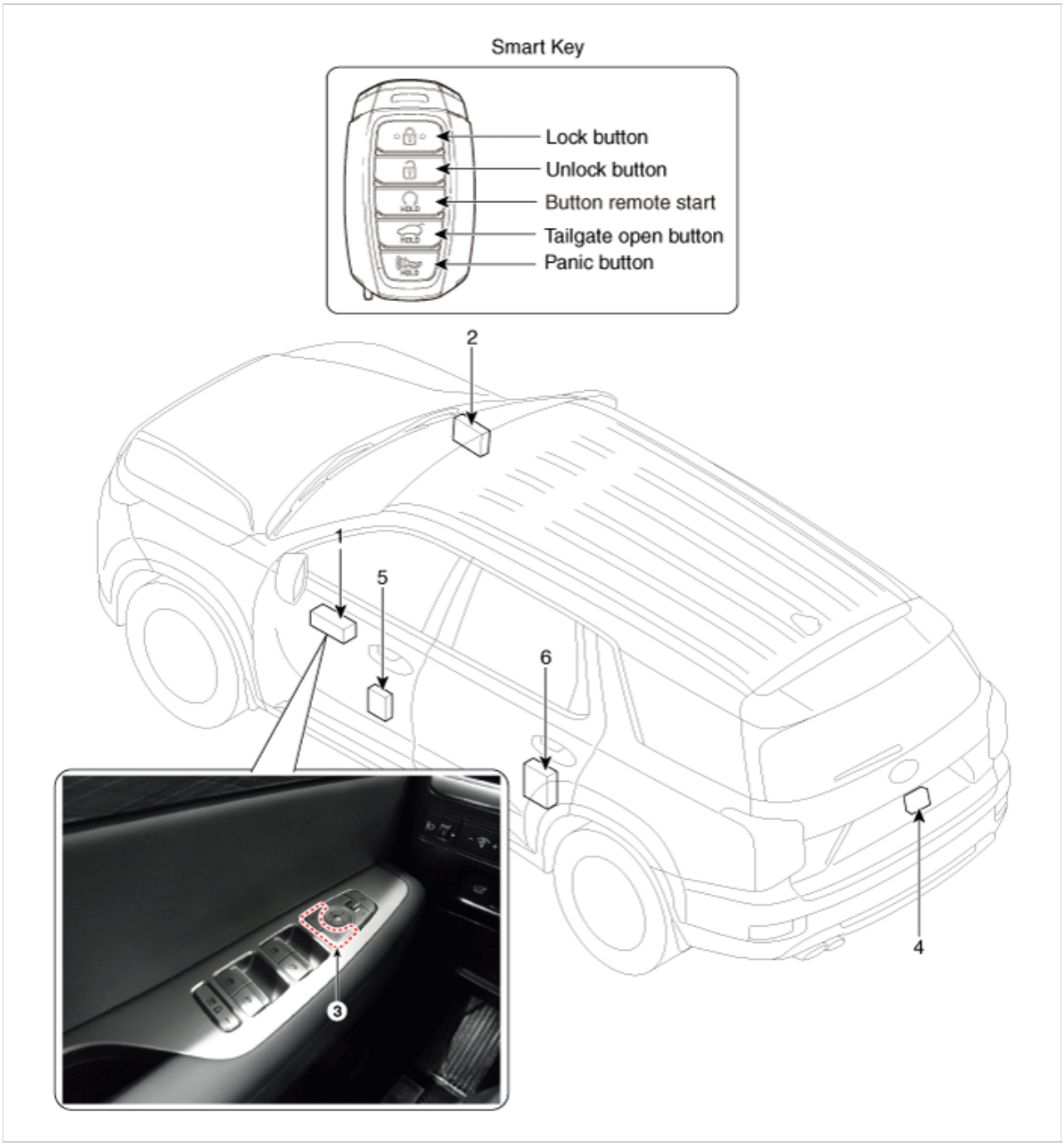

S/W Management
CLU Variant Coding
[CLU Variant Coding]
This function is intended to set for the specification of cluster in the vehicle which is applied to the vehicle system. (Option :ECS, MDPS, SCC and so on)
[Condition]
1. Ignition key on
2. Engine Status : Stop
Press [OK] button to continue.
Code information is not searched or there is no response from the server.
If you want to retry, click [OK],
or if you want to enter the code by manual, click [Manual].
If you want to finish, click [Cancel].
OK
Manual
Cancel
Do not touch any system buttons while performing this function.

- Troubleshooting

Symptom	Possible cause	Remedy
Speedometer does not operate	Cluster fuse (10A) blown	Check for short and replace fuse
	Speedometer faulty	Check speedometer
	CAN line faulty	Check the EMS
	Wiring or ground faulty	Repair if necessary
Tachometer does not operate	Cluster fuse (10A) blown	Check for short and replace fuse
	Tachometer faulty	Check tachometer
	CAN line faulty	Check the EMS
	Wiring or ground faulty	Repair if necessary
Fuel gauge does not operate	Cluster fuse (10A) blown	Check for short and replace fuse
	Fuel gauge faulty	Check gauge
	Fuel sender faulty	Check fuel sender
	Wiring or ground faulty	Repair if necessary
Low fuel warning lamp does not light up	Cluster fuse (10A) blown	Check for short and replace fuse

	Bulb burned out	Replace bulb
	Fuel sender faulty	Check fuel sender
	Wiring or ground faulty	Repair if necessary
Water temperature gauge does not operate	Cluster fuse (10A) blown	Check for short and replace fuse
	Water temperature gauge faulty	Check gauge
	Water temperature sender faulty	Check sender
	CAN line faulty	Check the EMS
	Wiring or ground faulty	Repair if necessary
Oil pressure warning lamp does not light up	Cluster fuse (10A) blown	Check for short and replace fuse
	Bulb burned out	Replace bulb
	Oil pressure switch faulty	Check switch
	Wiring or ground faulty	Repair if necessary
Parking brake warning lamp does not light up	Cluster fuse (10A) blown	Check for short and replace fuse
	Bulb burned out	Replace bulb
	Brake fluid level warning switch faulty	Check switch
	Parking brake switch faulty	Check switch
	Wiring or ground faulty	Repair if necessary
Open door warning lamp and tailgate warning lamp do not light up	Memory fuse (15A) blown	Check for short and replace fuse
	Bulb burned out	Replace bulb
	Door switch faulty	Check switch
	Wiring or ground faulty	Repair if necessary
Seat belt warning lamp does not light up	Cluster fuse (10A) blown	Check for short and replace fuse
	Bulb burned out	Replace bulb
	Seat belt switch faulty	Check switch
	Wiring or ground faulty	Repair if necessary
Speedometer and odometer does not operate	CAN line faulty	Check the ABS ECU
	Wheel speed sensor faulty	Check the wheel speed sensor

- Component Location

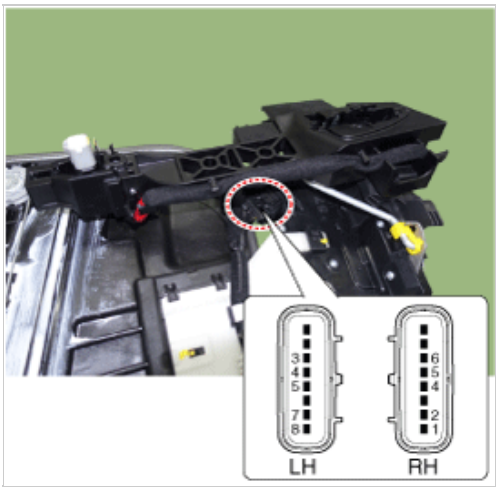


1. Driver power window main switch
2. IBU (Integrated Body Control Unit)
3. Door lock switch
4. Tailgate lock actuator & switch
5. Front door lock actuator & switch
6. Rear door lock actuator & switch

- Inspection

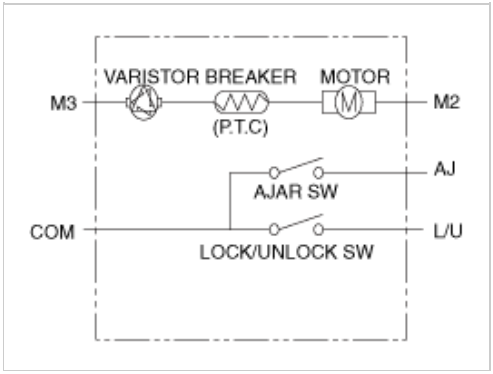
Front Door Lock Module Inspection

1. Remove the front door trim.
   (Refer to Body - "Front Door Trim")
2. Remove the front door module.
   (Refer to Body - "Front Door Module")
3. Disconnect the connectors from the actuator.



4. Check actuator operation by connecting power and ground according to the table. To prevent damage to the actuator, apply battery voltage only momentarily.

Pin	Driver		Panssenger	
	Central Lock	Power Child Lock	Central Lock	Power Child Lock
1	-	Power child switch	M1	M2
2	COM	COM	M2	M3
3	Lock/Unlock switch	Lock/Unlock switch	-	M1
4	AJAR	AJAR	-	M4
5	-	M4	AJAR	AJAR
6	-	M1	Lock/Unlock switch	Lock/Unlock switch
7	M2	M3	COM	COM
8	M1	M2	-	Power child switch

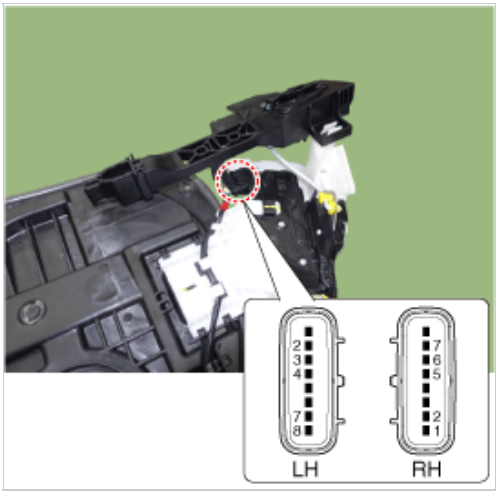


OPERATION / TERMINAL	C/LOCK	C/UNLOCK
	LH	LH
8	-	+
7	+	-
3 & 4	ON → OFF	OFF → ON
3 & 5	DR OPEN & Half Latching, ON Full Latching, OFF	

OPERATION / TERMINAL	C/LOCK	C/UNLOCK
	RH	RH
1	+	-
2	-	+
6 & 5	ON → OFF	OFF → ON
6 & 4	DR OPEN & Half Latching, ON Full Latching, OFF	

Rear Door Lock Module Inspection

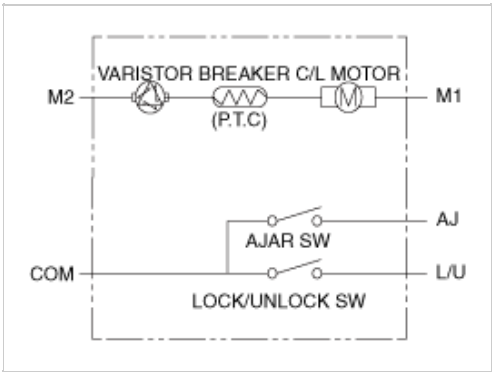
1. Remove the rear door trim.
   (Refer to Body - "Rear Door Trim")
2. Remove the rear door module.
   (Refer to Body - "Rear Door Module")
3. Disconnect the connectors from the actuator.



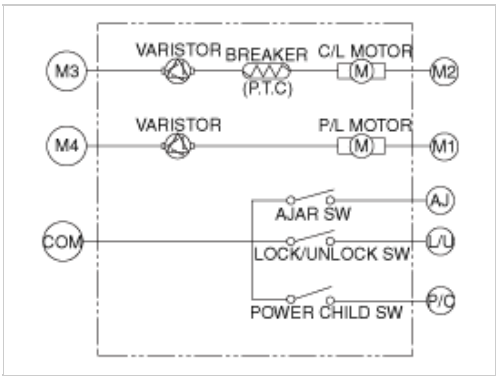
4. Check actuator operation by connecting power and ground according to the table. To prevent damage to the actuator, apply battery voltage only momentarily.

Terminal	Operation	
	LH	RH
1	-	M1
2	COM	M2
3	Lock/Unlock switch	-
4	AJAR	-
5	-	AJAR
6	-	Lock/Unlock switch
7	M2	COM
8	M1	-

[Central Lock]



[Power Child Lock]



[Central Lock]

OPERATION / TERMINAL	C/LOCK	C/UNLOCK
	LH	LH
8	-	+
7	+	-
2 & 3	ON → OFF	OFF → ON
2 & 4	DR OPEN & Half Latching, ON Full Latching, OFF	

OPERATION / TERMINAL	C/LOCK	C/UNLOCK
	RH	RH
1	+	-
2	-	+
7 & 6	ON → OFF	OFF → ON
7 & 5	DR OPEN & Half Latching, ON Full Latching, OFF	

[Power Child Lock]

OPERATION / TERMINAL	C/LOCK	C/UNLOCK	CHILD /LOCK	CHILD /UNLOCK
	LH	LH	LH	LH
8	-	+		
7	+	-		
6			-	+
5			+	-
2 & 3	ON → OFF	OFF → ON		
2 & 4	DR OPEN & Half Latching, ON Full Latching, OFF			
2 & 1			ON → OFF	OFF → ON

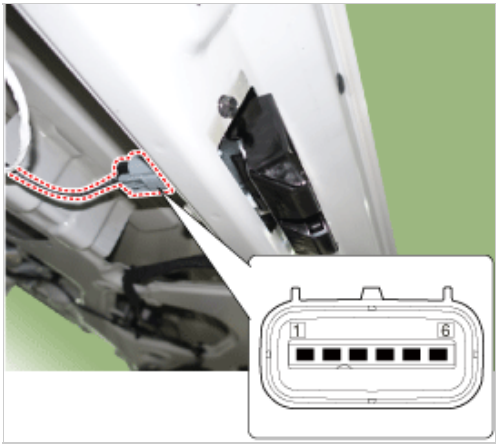
OPERATION / TERMINAL	C/LOCK	C/UNLOCK	CHILD /LOCK	CHILD /UNLOCK
	RH	RH	RH	RH
1	+	-		
2	-	+		
3			+	-
4			-	+
7 & 6	ON → OFF	OFF → ON		
7 & 5	DR OPEN & Half Latching, ON Full Latching, OFF			
7 & 8			ON → OFF	OFF → ON

Tailgate Lock Module Inspection

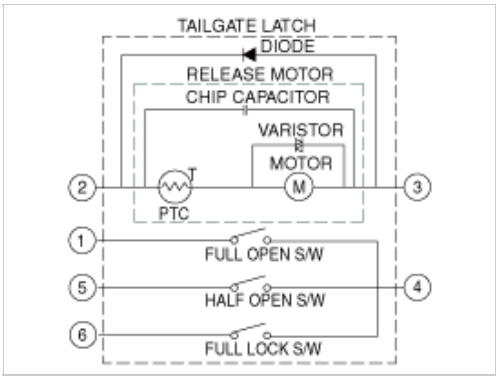
1. Remove the tailgate trim.

(Refer to Body - "Tailgate Trim")

2. Disconnect the 4P connector from the actuator.



3. Check for continuity between the terminals in each switch position according to the table.

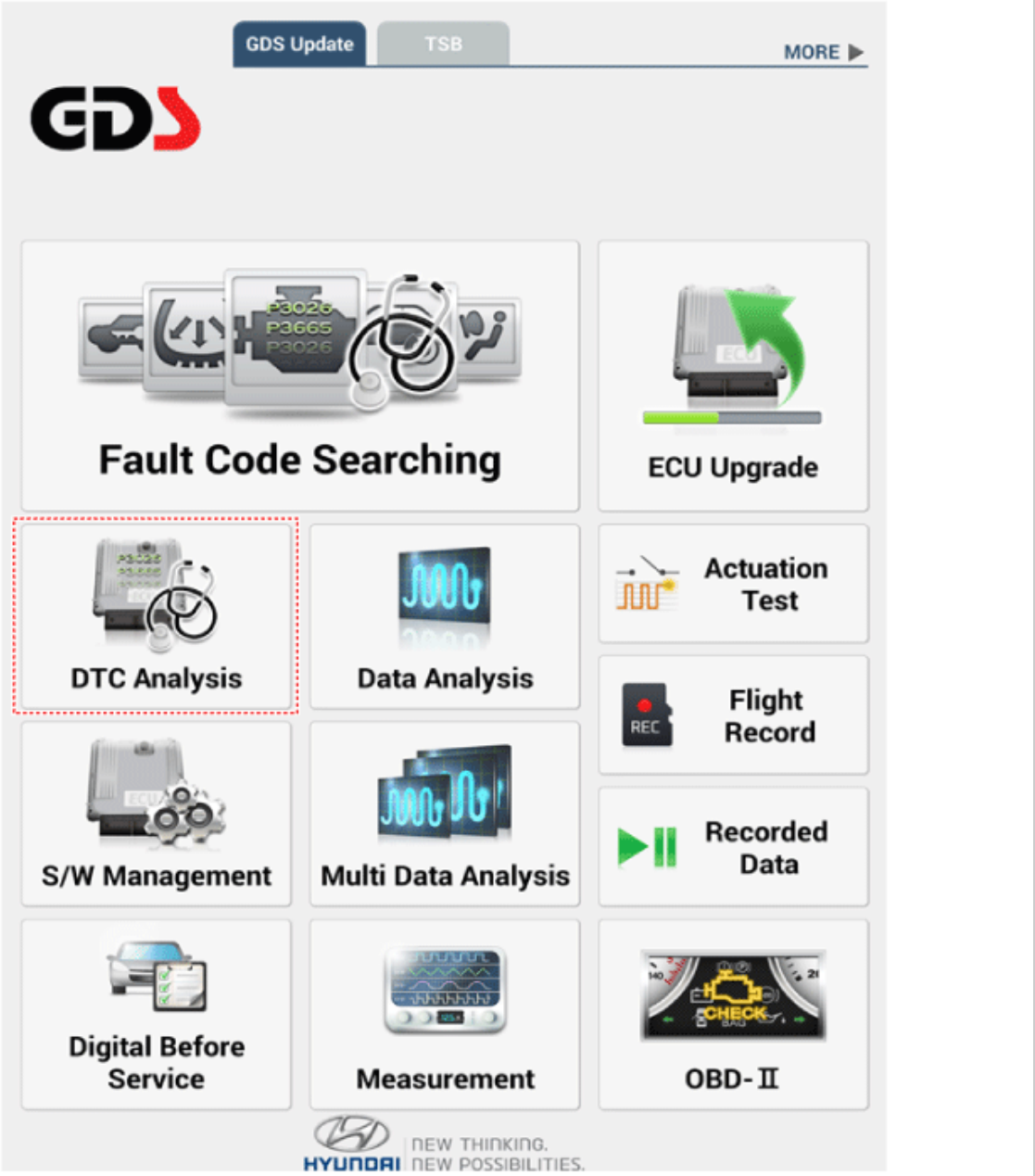


	MOTOR		SWITCH		
	2	3	1	5	6
FULL LOCK			OFF	OFF	OFF
HALF LOCK			ON	OFF	ON
FULL OPEN	+	-	ON	ON	ON

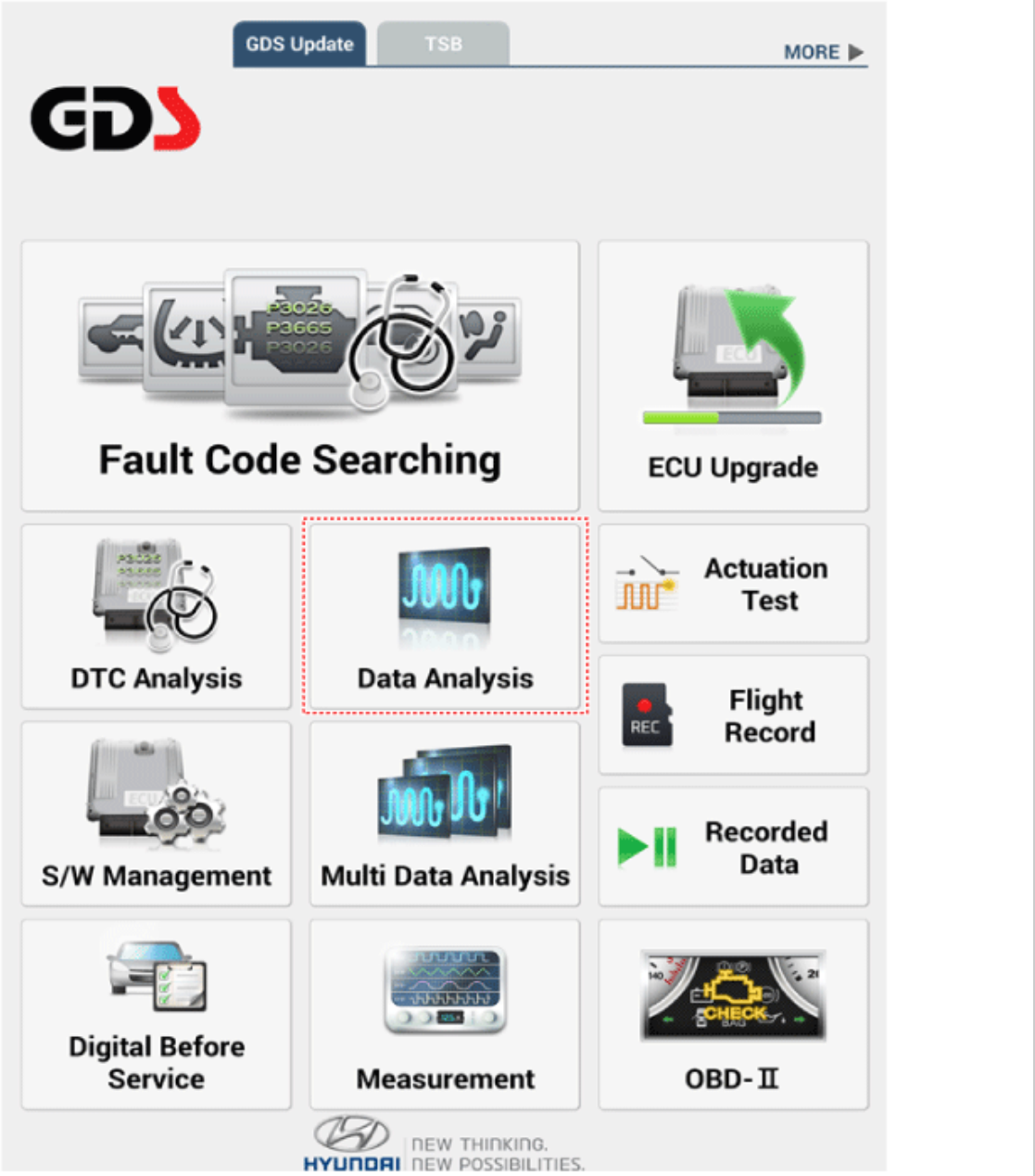
- Diagnosis with Diagnostic tool

Diagnosis with Diagnostic tool

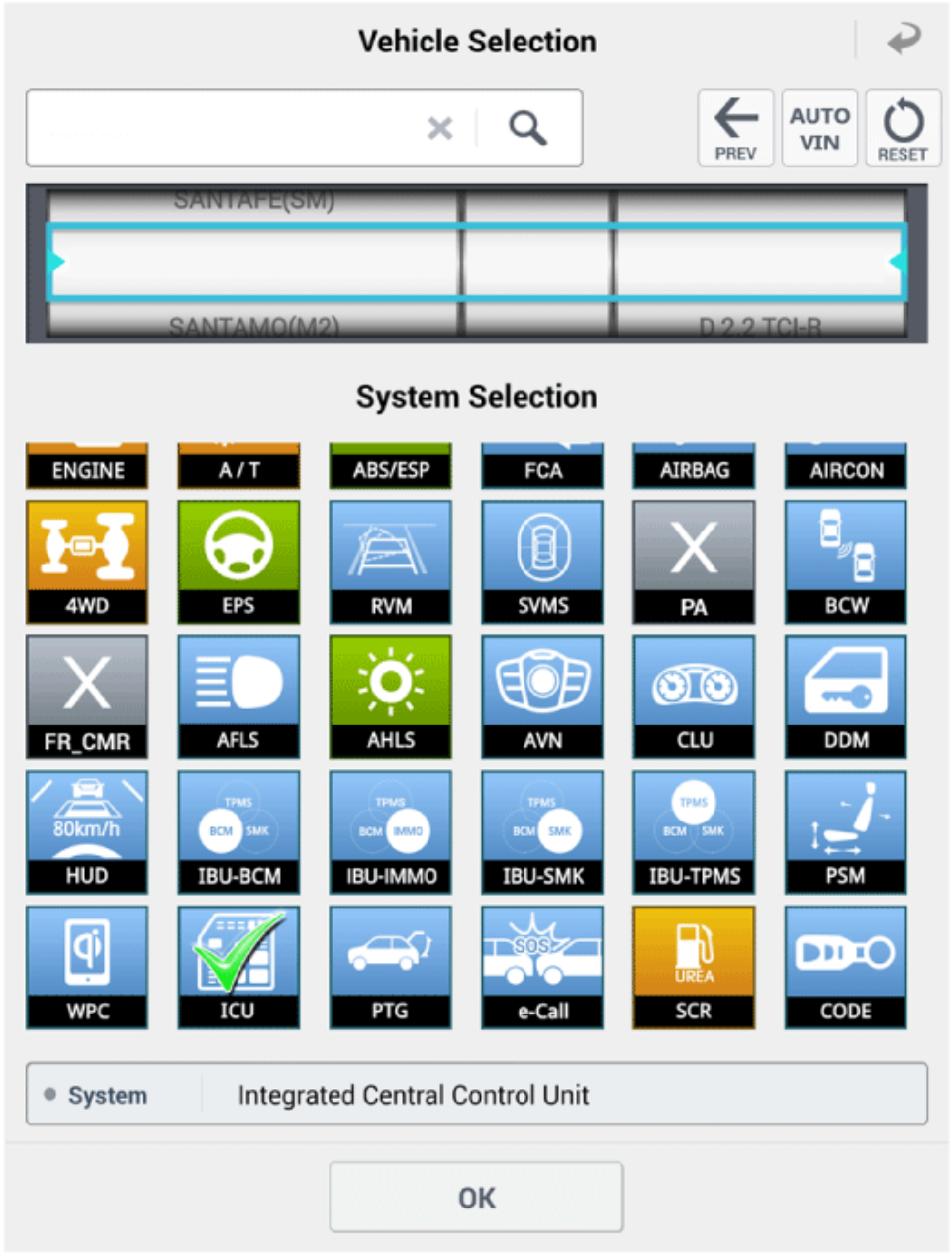
1. In the body electrical system, failure can be quickly diagnosed by using the vehicle diagnostic system (Diagnostic tool).
   The diagnostic system (Diagnostic tool) provides the following information.
   (1) Fault Code Searching : Checking failure and code number (DTC)
   (2) Data Analysis : Checking the system input/output data state
   (3) Actuation test : Checking the system operation condition
   (4) S/W Management : Controlling other features including system option setting and zero point adjustment
2. If diagnose the vehicle by Diagnostic tool, select "DTC Analysis" and "Vehicle".

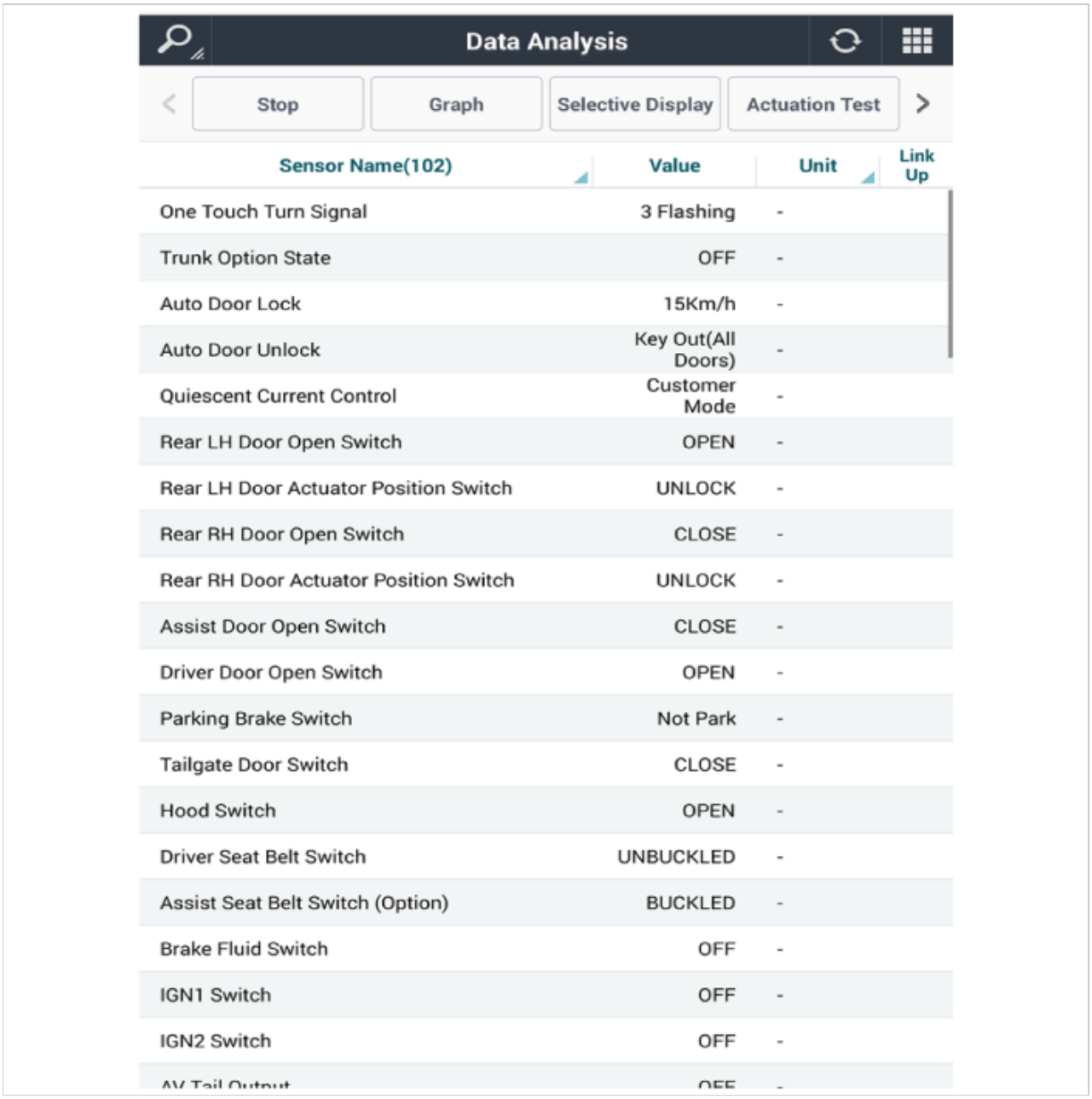


3. If check current status, select the "Data Analysis" and "Car model".

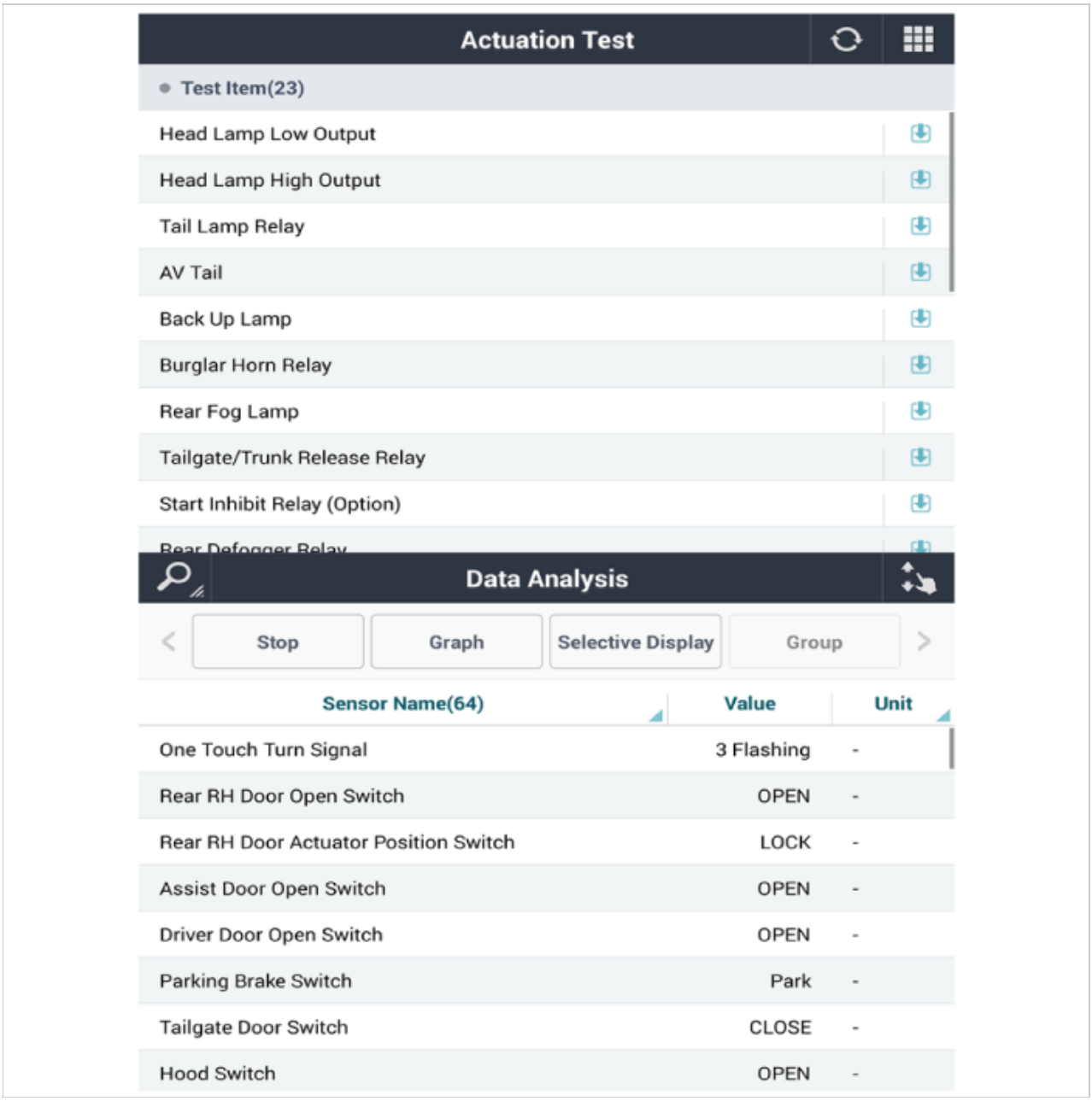


4. Select the 'ICU' to search the current state of the input/output data.


Vehicle Selection
PREV
AUTO VIN
RESET
SANTAFE(SM)
SANTAMO(M2)
D 2.2 TCI-R
System Selection
ENGINE
A / T
ABS/ESP
FCA
AIRBAG
AIRCON
4WD
EPS
RVM
SVMS
PA
BCW
FR_CMR
AFLS
AHLS
AVN
CLU
DDM
80km/h
HUD
IBU-BCM
IBU-IMMO
IBU-SMK
IBU-TPMS
PSM
WPC
ICU
PTG
e-Call
SCR
CODE
System
Integrated Central Control Unit
OK



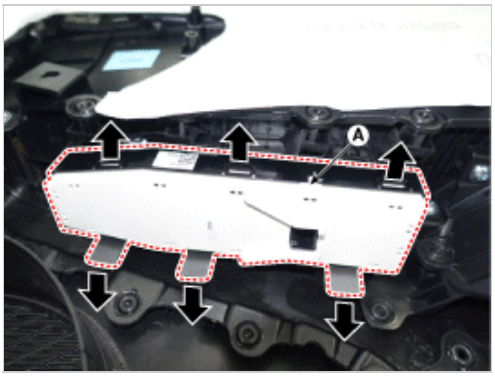
5. To forcibly actuate the input value of the module to be checked, select option 'Actuation Test'.



- Removal

Driver Power Window Switch

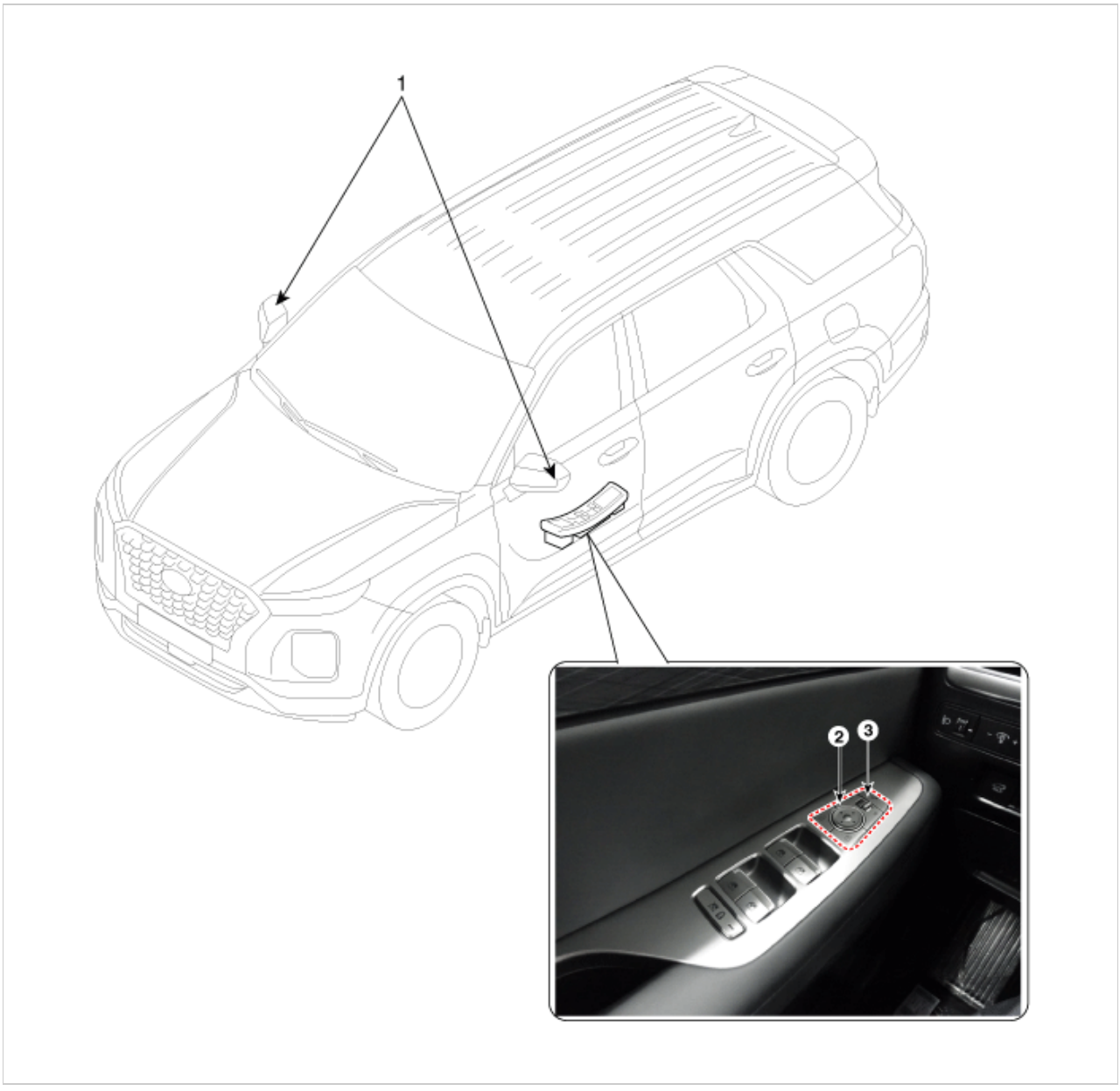
1. Disconnect the negative (-) battery terminal.
2. Remove the front door trim.
   (Refer to Body - "Front Door Trim")
3. Disengage the mounting clip and then remove the door rock switch assembly (A).



- Installation

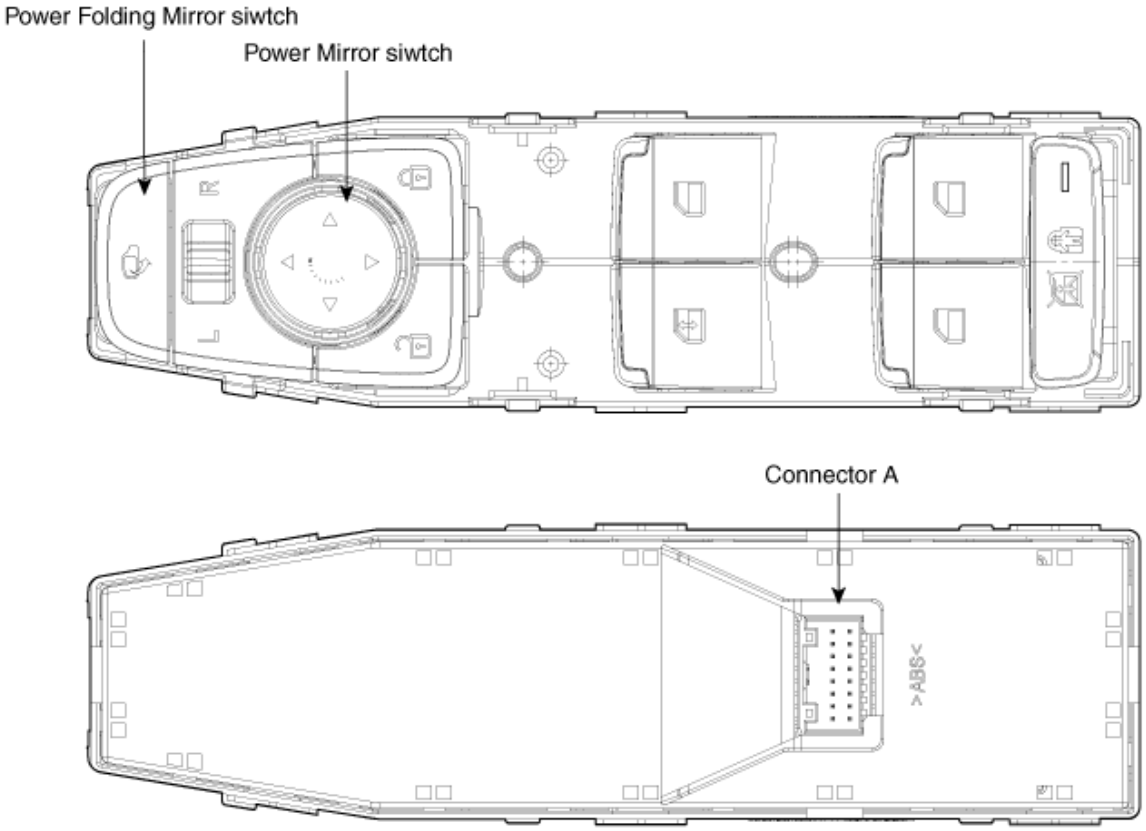
1. Install the door lock switch assembly.
2. Install the front door trim after connecting the connector.

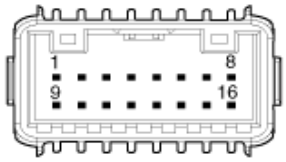
- Component Location

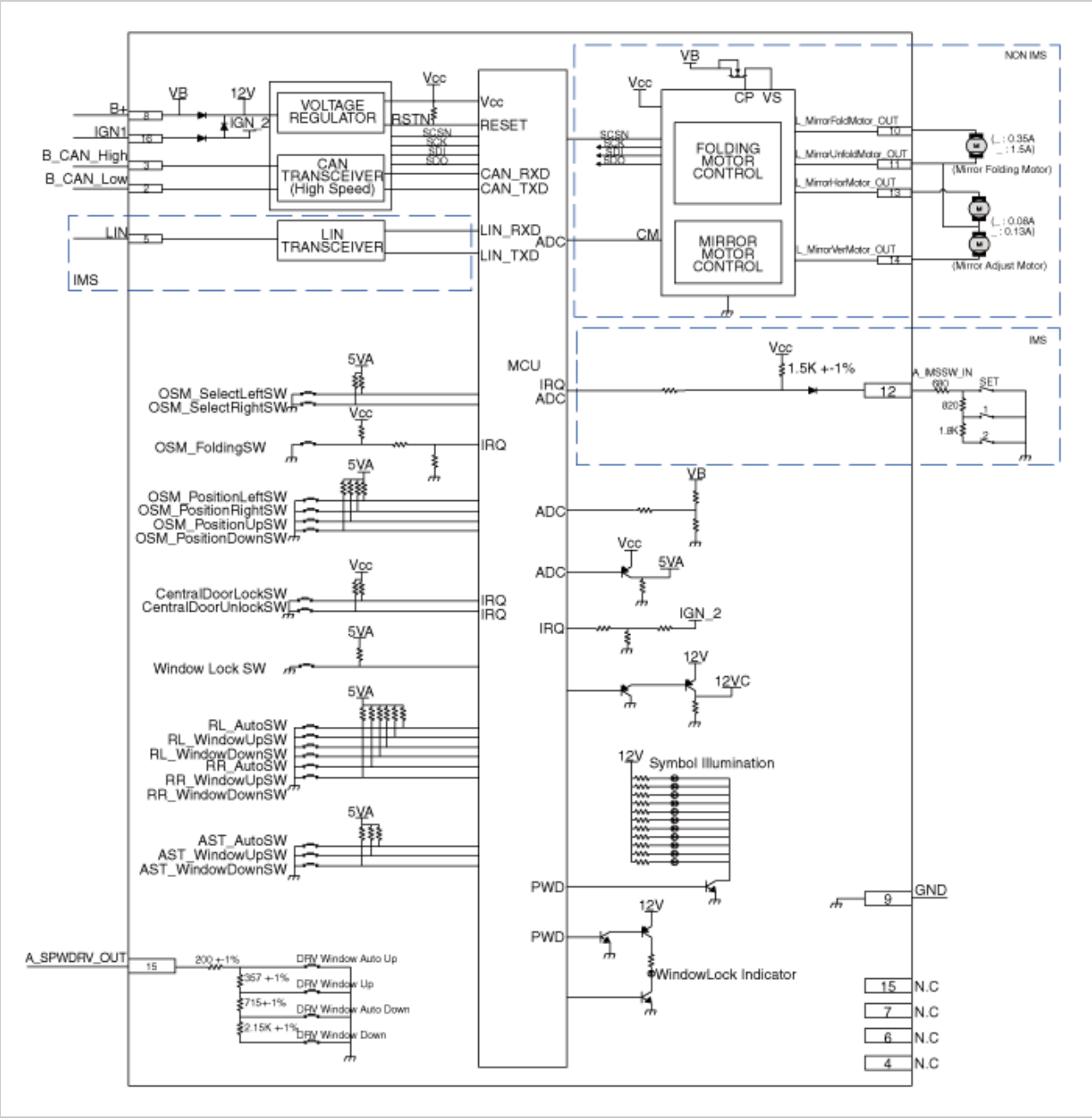


1. Power door mirror
2. Power door mirror switch
3. Power folding mirror switch

- Circuit Diagram



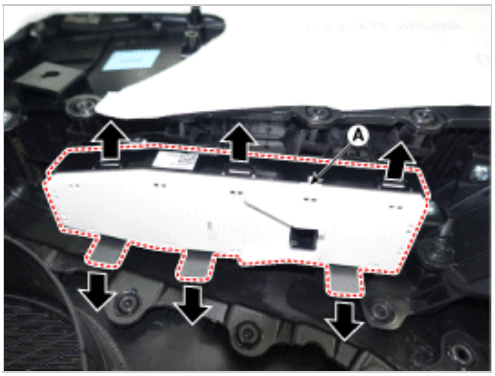
Connector A	No.	Description	No.	Description
	1	-	9	GND
	2	B_CAN (Low)	10	-
	3	B_CAN (High)	11	-
	4	-	12	IMS Switch
	5	LIN	13	-
	6	-	14	-
	7	-	15	Drive Sefety Window
	8	Battery (+)	16	IGN 1



Body Electrical System

- Removal

1. Disconnect the negative (-) battery terminal.
2. Remove the front left door trim.
   (Refer to Body - "Front Door Trim")
3. Disengage the mounting clip and then remove the door rock switch assembly (A).



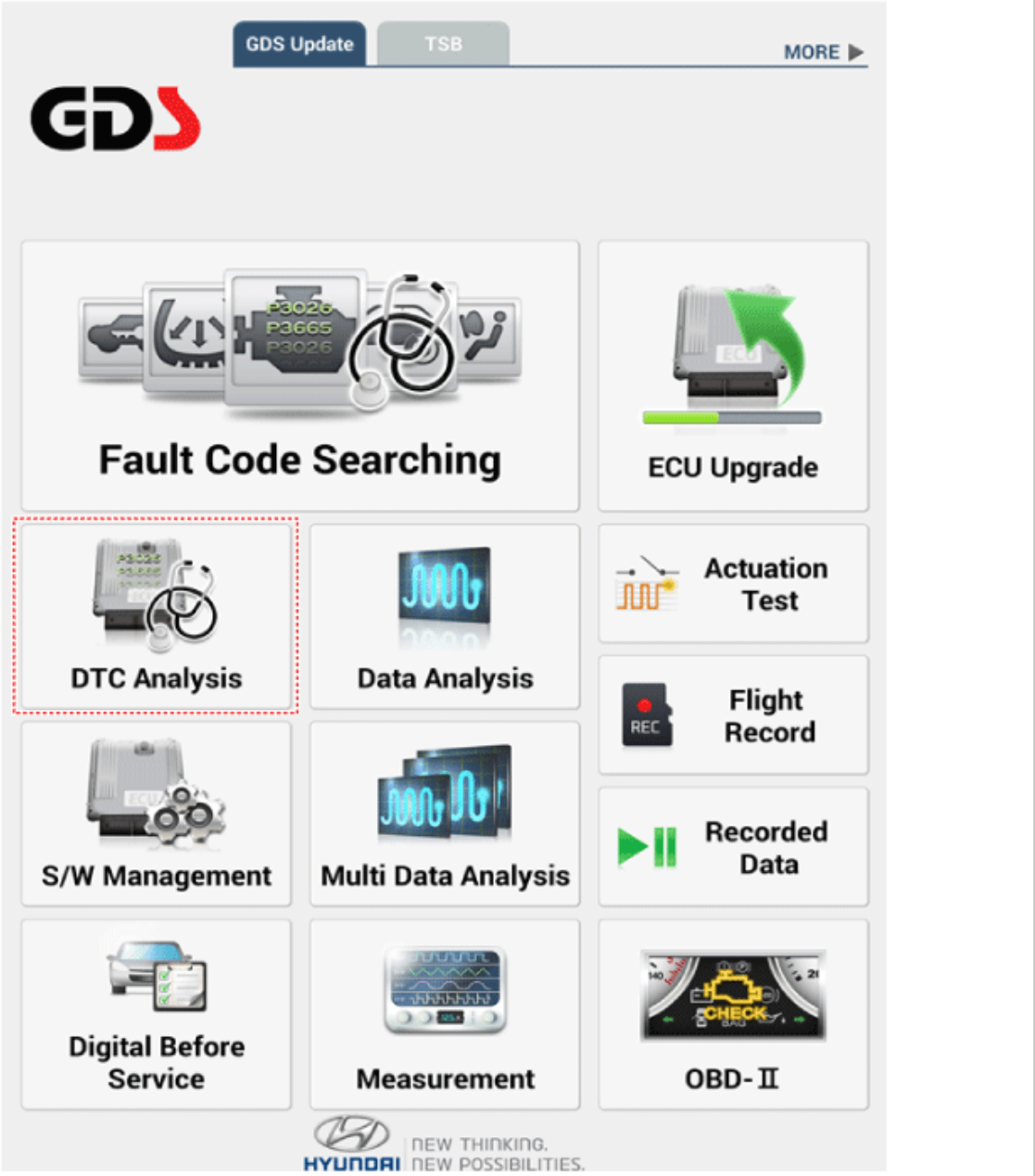
- Installation

1. Install the power mirror switch.
2. Install the front door trim after connecting the connector.
3. Connect the negative (-) battery terminal.

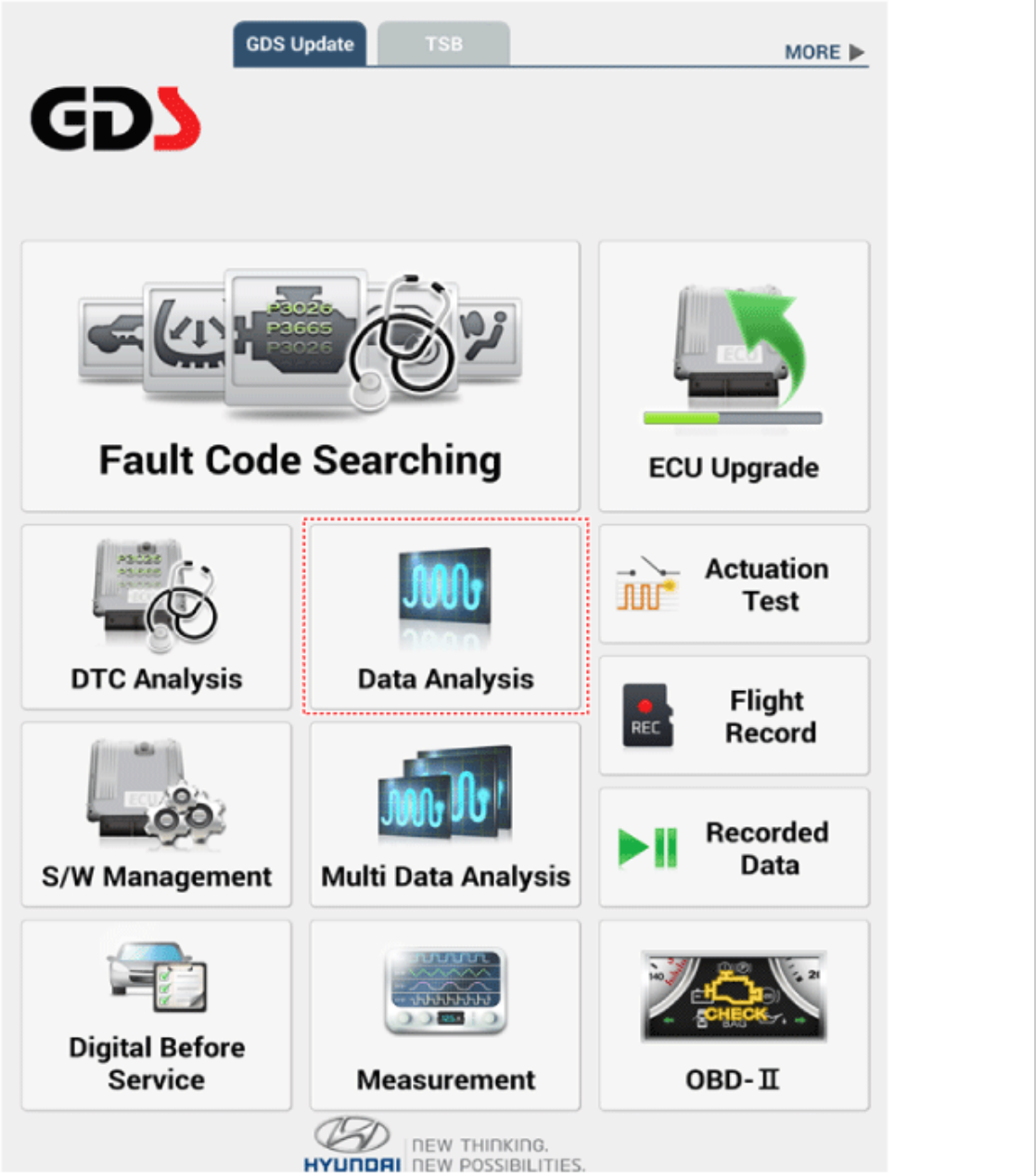
- Inspection

Diagnosis with Diagnostic tool

1. In the body electrical system, failure can be quickly diagnosed by using the vehicle diagnostic system (Diagnostic tool). The diagnostic system (Diagnostic tool) provides the following information.
   (1) Fault Code Searching : Checking failure and code number (DTC)
   (2) Data Analysis : Checking the system input/output data state
   (3) Actuation test : Checking the system operation condition
   (4) S/W Management : Controlling other features including system option setting and zero point adjustment
2. If diagnose the vehicle by Diagnostic tool, select "DTC Analysis" and "Vehicle".

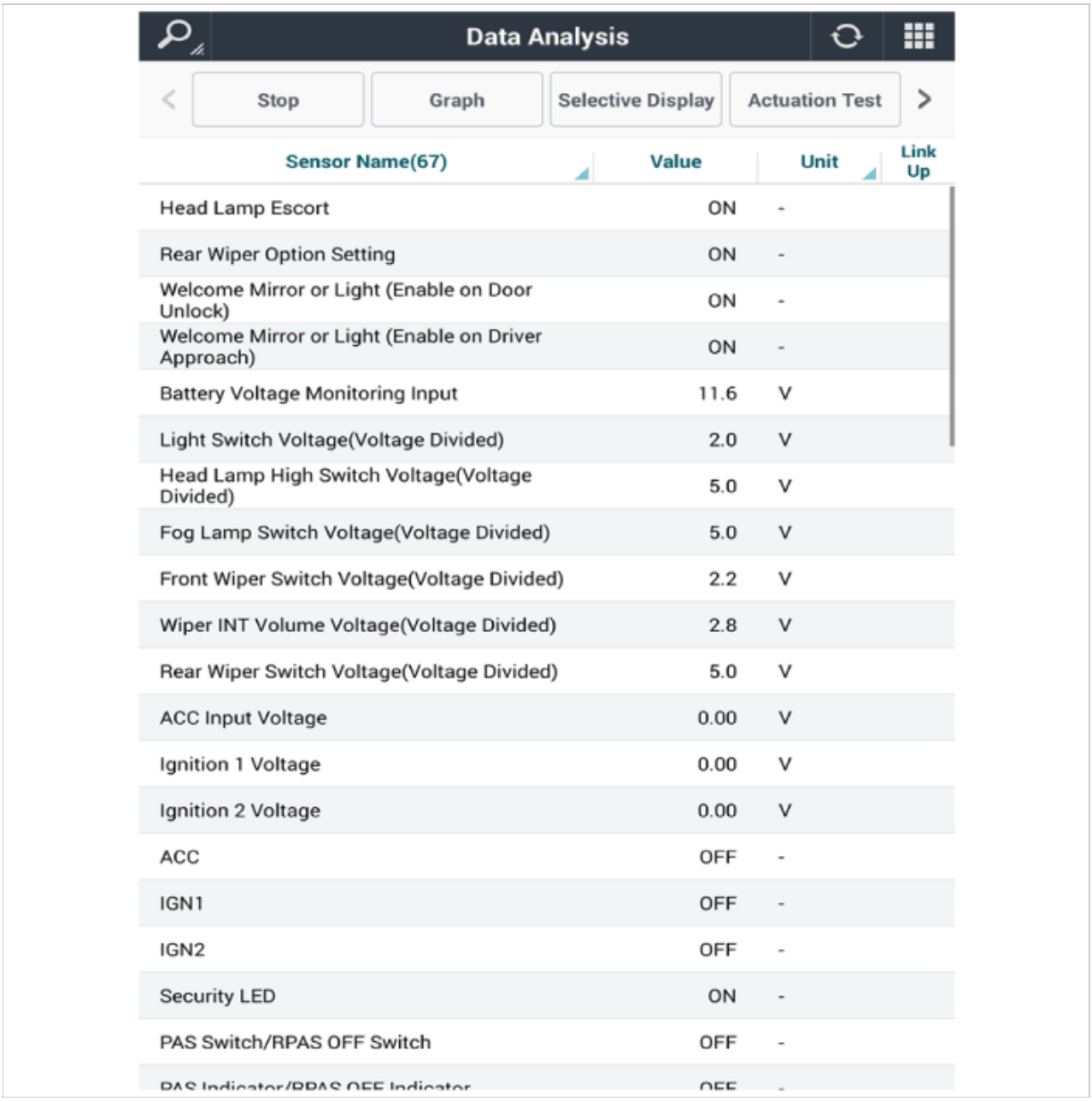


3. If check current status, select the "Data Analysis" and "Car model".

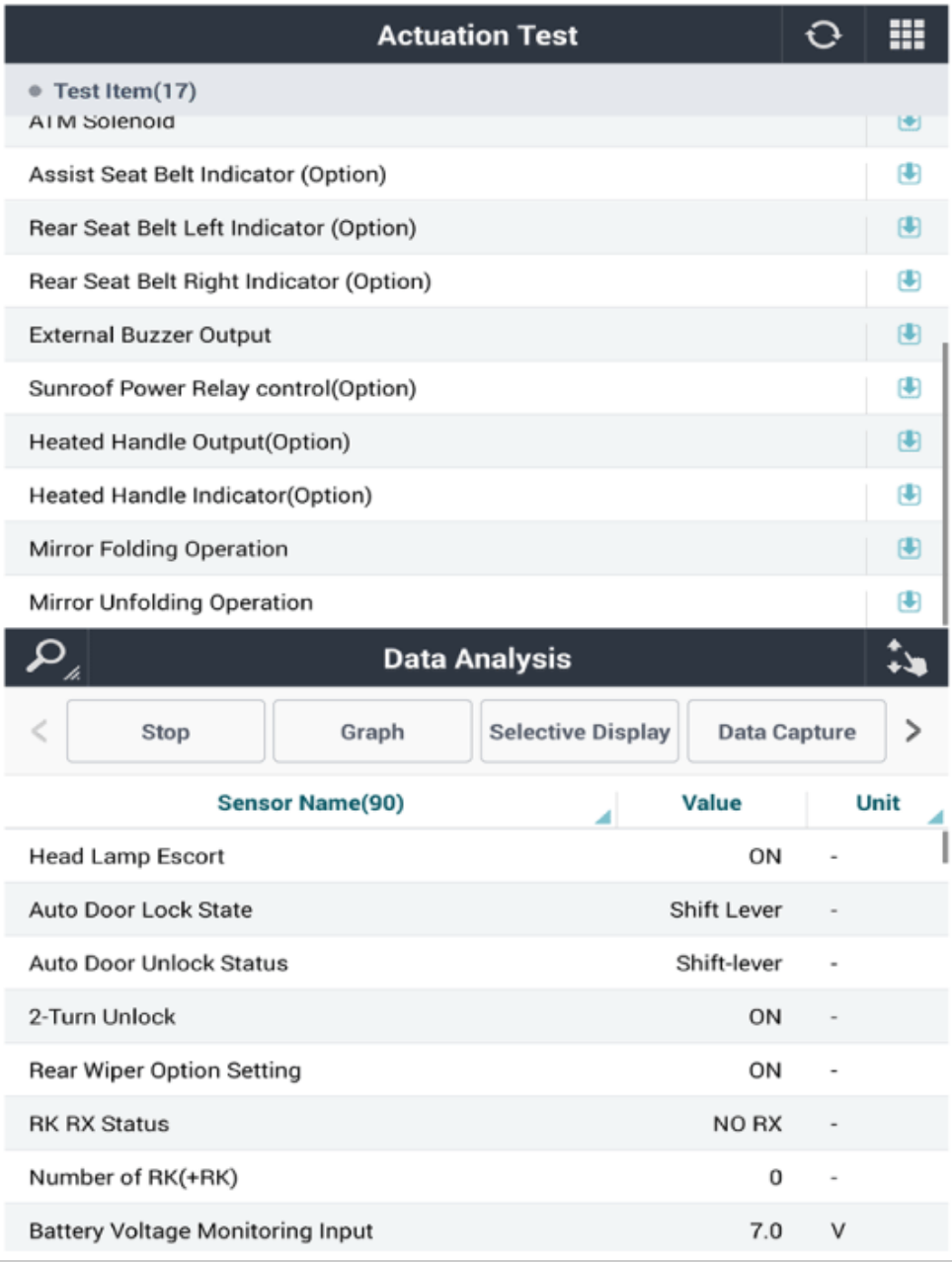


4. Select the 'IBU_BCM' to search the current state of the input/output data.

Vehicle Selection
PREV
AUTO VIN
RESET
SANTAFE(SM)
SANTAMO(M2)
D 2.2 TCI-R
System Selection
ENGINE
A / T
ABS/ESP
FCA
AIRBAG
AIRCON
4WD
EPS
RVM
SVMS
PA
BCW
FR_CMR
AFLS
AHLS
AVN
CLU
DDM
80km/h
HUD
IBU-BCM
IBU-IMMO
IBU-SMK
IBU-TPMS
PSM
System
IBU-BCM
OK

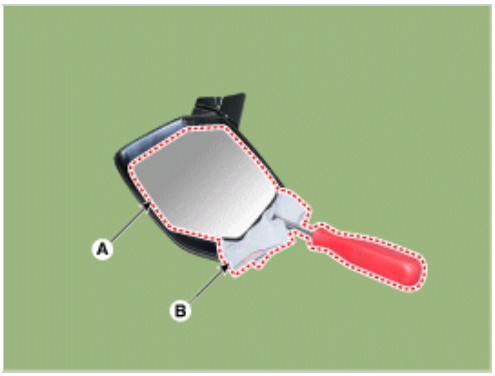

Data Analysis
Stop
Graph
Selective Display
Actuation Test
Sensor Name(67)
Value
Unit
Link Up
Head Lamp Escort ON -
Rear Wiper Option Setting ON -
Welcome Mirror or Light (Enable on Door Unlock) ON -
Welcome Mirror or Light (Enable on Driver Approach) ON -
Battery Voltage Monitoring Input 11.6 V
Light Switch Voltage(Voltage Divided) 2.0 V
Head Lamp High Switch Voltage(Voltage Divided) 5.0 V
Fog Lamp Switch Voltage(Voltage Divided) 5.0 V
Front Wiper Switch Voltage(Voltage Divided) 2.2 V
Wiper INT Volume Voltage(Voltage Divided) 2.8 V
Rear Wiper Switch Voltage(Voltage Divided) 5.0 V
ACC Input Voltage 0.00 V
Ignition 1 Voltage 0.00 V
Ignition 2 Voltage 0.00 V
ACC OFF -
IGN1 OFF -
IGN2 OFF -
Security LED ON -
PAS Switch/RPAS OFF Switch OFF -

5. To forcibly actuate the input value of the module to be checked, select option 'Actuation Test'.



- Removal

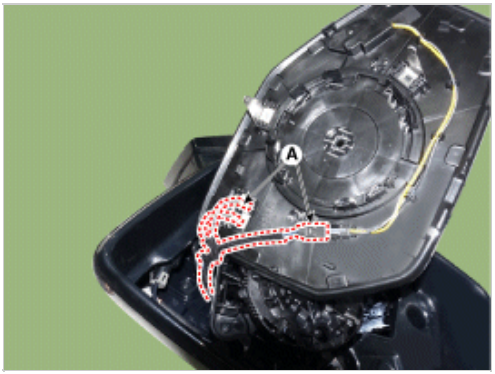
1. Disconnect (-) battery terminal.
2. Using a fastener remover (C), remove the mirror (A) as illustration below.



⚠ CAUTION

- Protect mirror from removing tool with cloth (B) wrapped.
- Be careful not to damage mirror and mirror housing during removing process.
- Apply force around the center of mirror because to apply force the end of mirror will break it.

3. Disconnect heat wire connectors (A) and then remove the mirror.



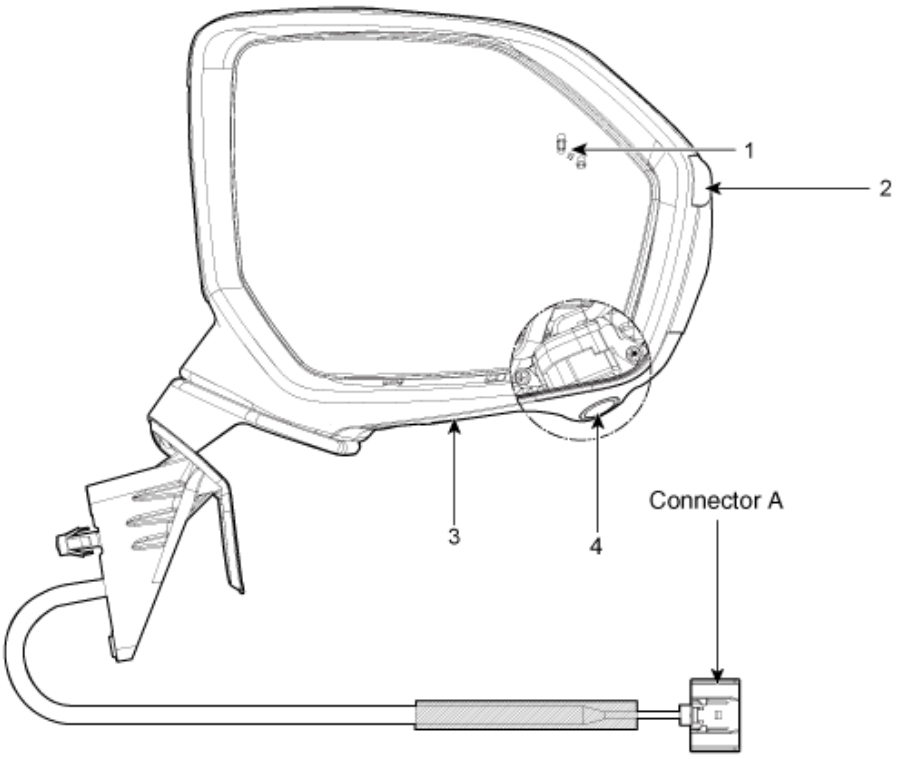
4. Remove the mirror actuator mounting screw.

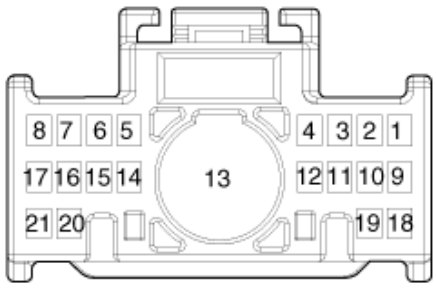
5. Disconnect the connector (A) and then remove the mirror actuator.

- Installation

1. Connect the actuator connector and then install the mirror actuator.
2. Connect mirror heat wire connector and then install the mirror.
3. Connect (-) battery terminal then check if mirror works normally.

- Components



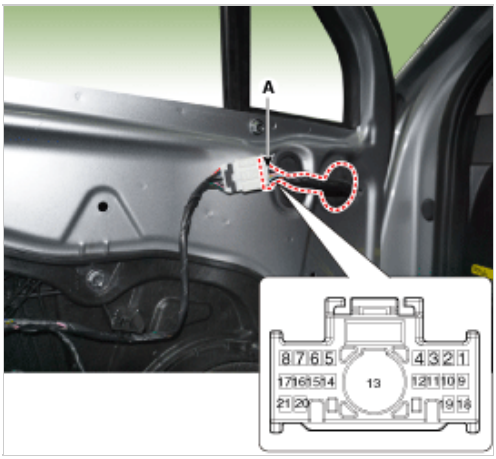


Pin	Description	Pin	Description
1	Mirror vertical motor	10	Mirror folding
2	Common	11	Mirror unfolding
3	Mirror horizontal motor	12	Camera signal/Ground
4	Heater (+)	13	Heater (-)/Side repeater lamp (-)
5	Side repeater lamp (+)	14	Blind spotr radar indicator (-)
6	Blind spotr radar indicator (+)	15	Puddle lamp (-)
7	Puddle lamp (+)	16	Camera power (-)
8	Camera power (+)	17	-
9	-	18	-

1. Blind spot radar warning indicator
2. Side repeater lamp
3. Puddle lamp
4. SVM camera

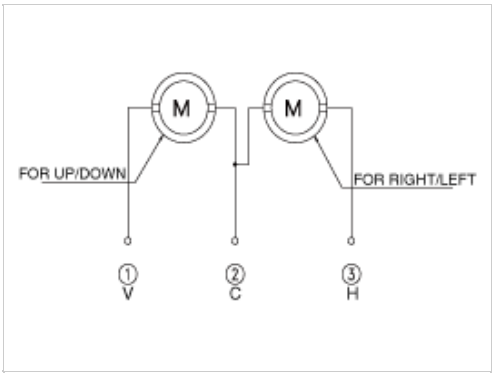
- Inspection

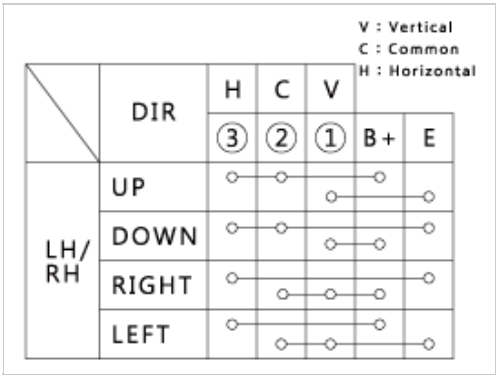
1. Disconnect the negative (-) battery terminal.
2. Remove the door trim.
   (Refer to Body - "Front Door Trim")
3. Disconnect the power door mirror connector (A) from the harness.



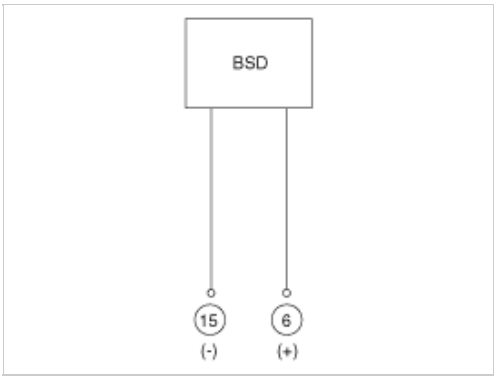
4. Apply battery voltage to each terminal as shown in the table and verify that the mirror operates properly.

[Actuator]

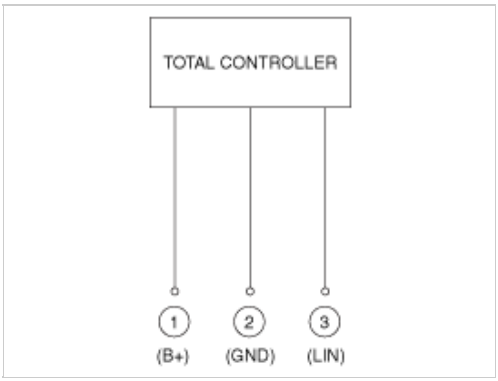




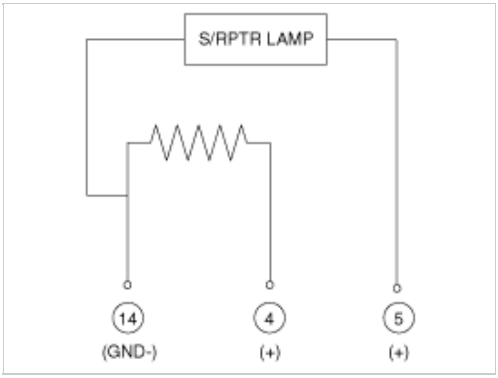
Blind spot radar Indicator



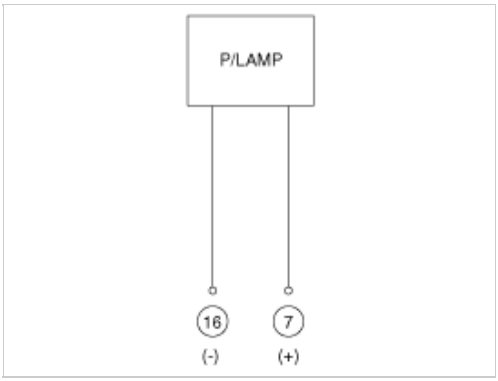
Control Unit



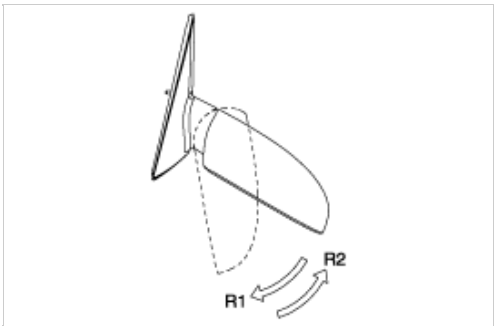
Mirror Heater



Puddle Lamp



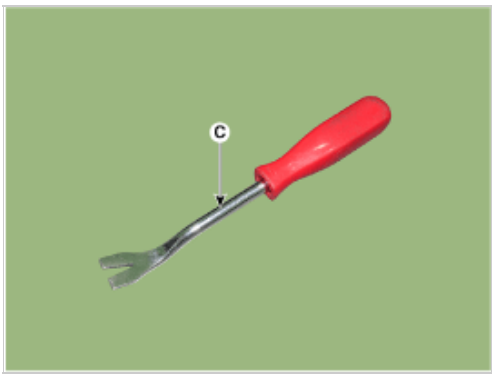
Folding Mirror

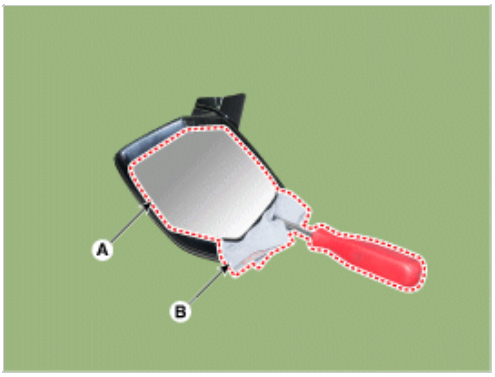


Terminal / Position	B(+)	GND(-)	11	12
Folding (R1)	○		○	
		○		○
Unfolding (R2)	○			○
		○	○	

- Removal

1. Disconnect (-) battery terminal.
2. Using a fastener remover (C), remove the mirror (A) as illustration below.

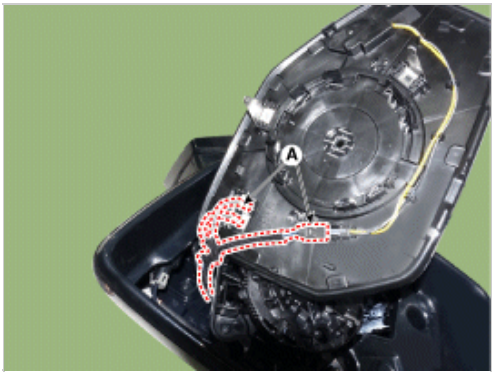




⚠ CAUTION

- Protect mirror from removing tool with cloth (B) wrapped.
- Be careful not to damage mirror and mirror housing during removing process.
- Apply force around the center of mirror because to apply force the end of mirror will break it.

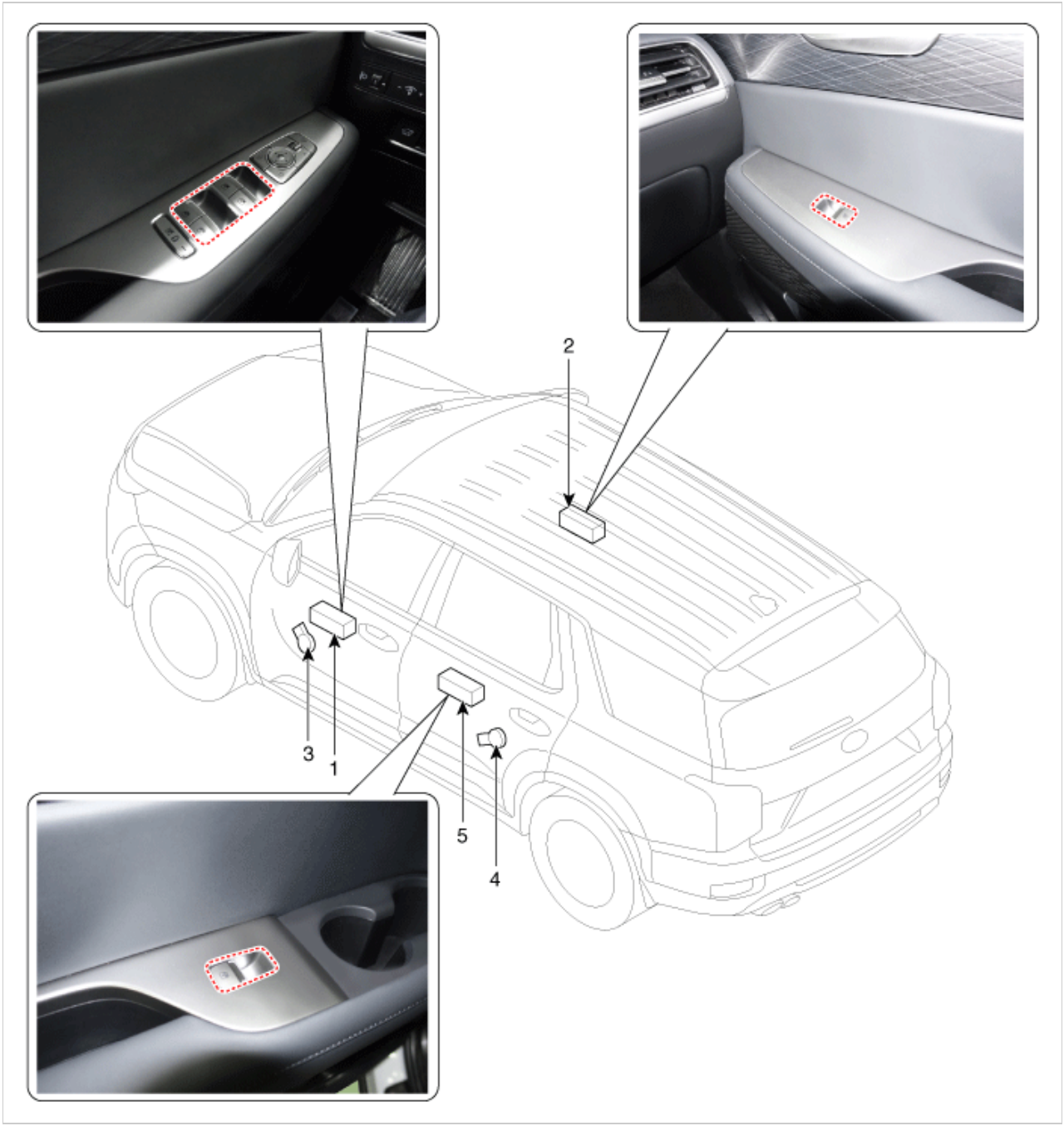
3. Disconnect heat wire connectors (A) and then remove the mirror.



- Installation

1. Install the mirror after connecting mirror connectors.
2. Connect (-) battery terminal then check if mirror works normally.

- Component Location

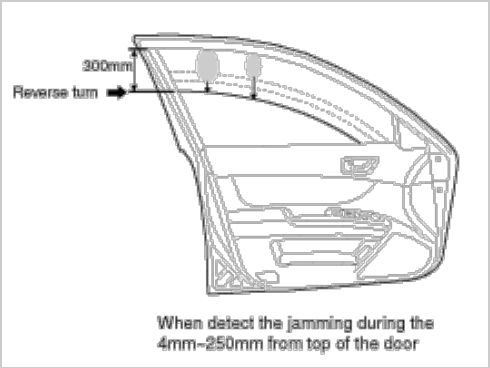


1. DDM (Driver door module)
2. ADM (Assistant door module)
3. Front window motor
4. Rear window motor
5. Rear window switch

- Function Of Safety Power Window

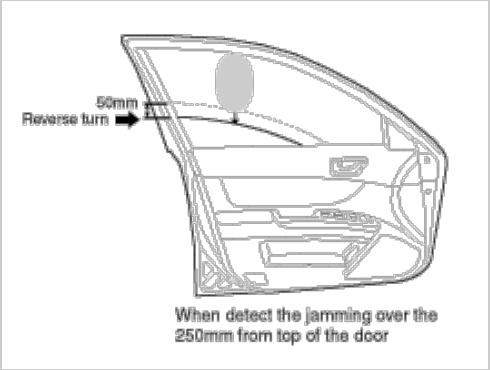
When driver door power window auto-up switch is operated, safety function is activated.

1. Safety function condition
   When detect the force of 100N (using the 10N/mm spring) during the window rising, window is reversed.
2. Length of window reversing (except holding the auto-up switch)
   – When detect the jamming during the 4mm - 250mm from top of the door.
   → Window is reversed until 300mm from top of the door.



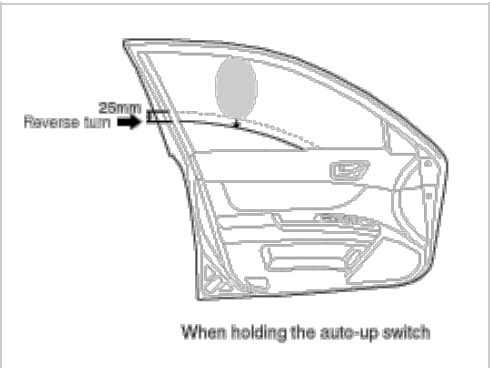
When detect the jamming during the 4mm~250mm from top of the door

– When detect the jamming over the 250mm from top of the door.
→ Window is reversed until 20mm from jamming position.



When detect the jamming over the 250mm from top of the door

3. Length of window reversing (holding the auto-up switch)
   – When detect the jamming during holding the auto-up switch.
   → Window is reverse until 25mm from jamming position.
   – Auto-up function is not available during the 5 seconds from above condition.
   → When holding the auto-up switch, window is operated as a manual-up function. (Safety function is not activated.)
   – When holding the auto-up switch after 5 seconds from above condition.
   → Window is reverse until 25mm from jamming position.



When holding the auto-up switch

4. Safety function is not available area
   Safety function is not available during the 4mm from top of the door.

Initializing Method of the Safety Power Window

1. Initializing of Battery Connection
   When the battery power is removed for over 5 minutes, safety power window switch need the initializing.
   (1) Power window operation before initializing
      – Manual-Up/Down function is available
      – Auto-Up function is not available
      (When holding the auto-up/down switch, window is operated as a manual-up/down.)
   (2) Initializing method
      Close the window in window open position, and holding the switch in window full close position over the 0.2 second.

(If start the closing the window in window full close position, initializing could be failed.)

(3) If initialize the safety power window in jamming status, could occur below conditions.

– Safety function is not available

2. Initializing of fail safe mode

(1) If the window moved by compulsion and motor have a problem, power window switch could be entering the fail safe mode for user's safety.

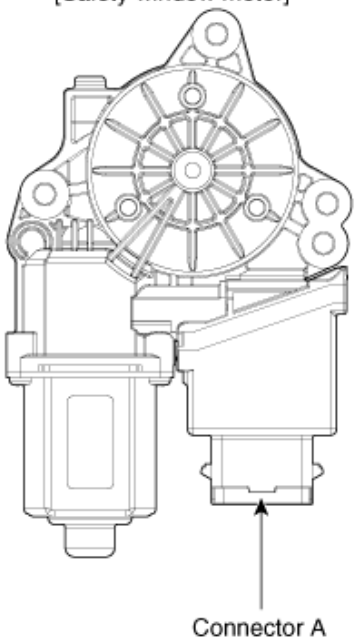
(2) Power window operation in fail mode

– Auto/Manual-Down function is available

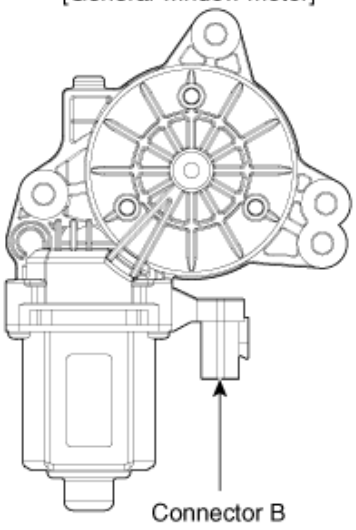
– Auto/Manual-Up function is not available
(When auto/manual-up is operated, window is rising 20mm and is stopped the moving.)

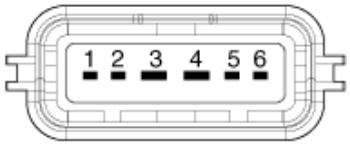
- Components

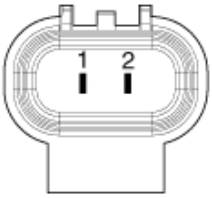
[Safety window motor]



[General window motor]



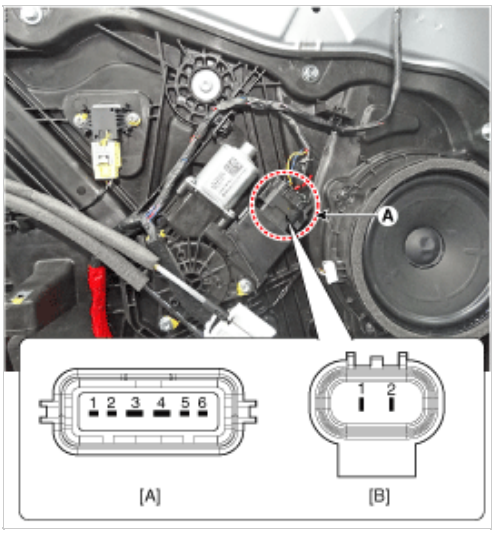
Connector A	
	
Pin	Description
1	Switch 1
2	Enable
3	Battery +
4	Ground
5	LIN
6	Switch 2

Connector B	
	
Pin	Description
1	Battery +
2	Ground

- Inspection

Front Power Window Motor

1. Disconnect the negative (-) battery terminal.
2. Remove the front door trim.
   (Refer to Body - "Front Door Trim")
3. Disconnect the connector (A) from the motor.
   (A : Safety, B : Standard)



4. Connect the motor terminals directly to battery voltage (12V) and check that the motor operates smoothly. Next, reverse the polarity and check that the motor operates smoothly in the reverse direction. If the operation is abnormal, replace the motor.

[Standard Window motor]

Position \ Terminal			1	2
Left	Up	Counter-clockwise	⊕	⊖
	Down	Clockwise	⊖	⊕
Right	Up	Clockwise	⊕	⊖
	Down	Counter-clockwise	⊖	⊕

5. Connect the terminal No. 2 and No. 3 to battery voltage (12V) and check that the motor operates smoothly when connecting the terminals below.

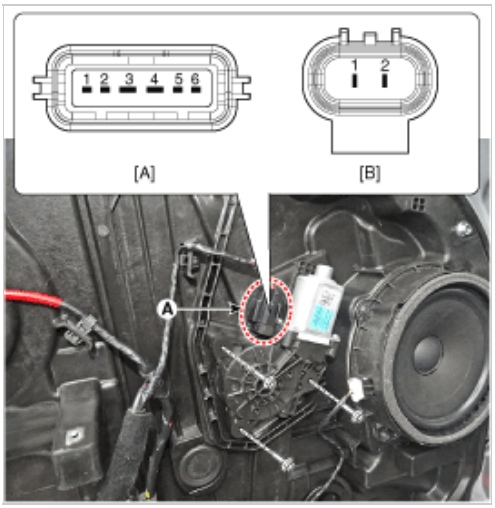
[Safety Window motor]

Position \ Terminal			1	4(GND)	6
Left	Up	Counter -clockwise	○—○		
	Down	Clockwise		○—○	
Right	Up	Clockwise	○—○		
	Down	Counter-clockwise		○—○	

Rear Power Window Motor

1. Disconnect the negative (-) battery terminal.
2. Remove the rear door trim.
   (Refer to Body - "Rear Door Trim")
3. Disconnect the connector (A) from the motor.

(A : Safety, B : Standard)



4. Connect the motor terminals directly to battery voltage (12V) and check that the motor operates smoothly. Next, reverse the polarity and check that the motor operates smoothly in the reverse direction. If the operation is abnormal, replace the motor.

[Standard Window motor]

Position		Terminal	1	2
Left	Up	Counter-clockwise	⊕	⊖
	Down	Clockwise	⊖	⊕
Right	Up	Clockwise	⊕	⊖
	Down	Counter-clockwise	⊖	⊕

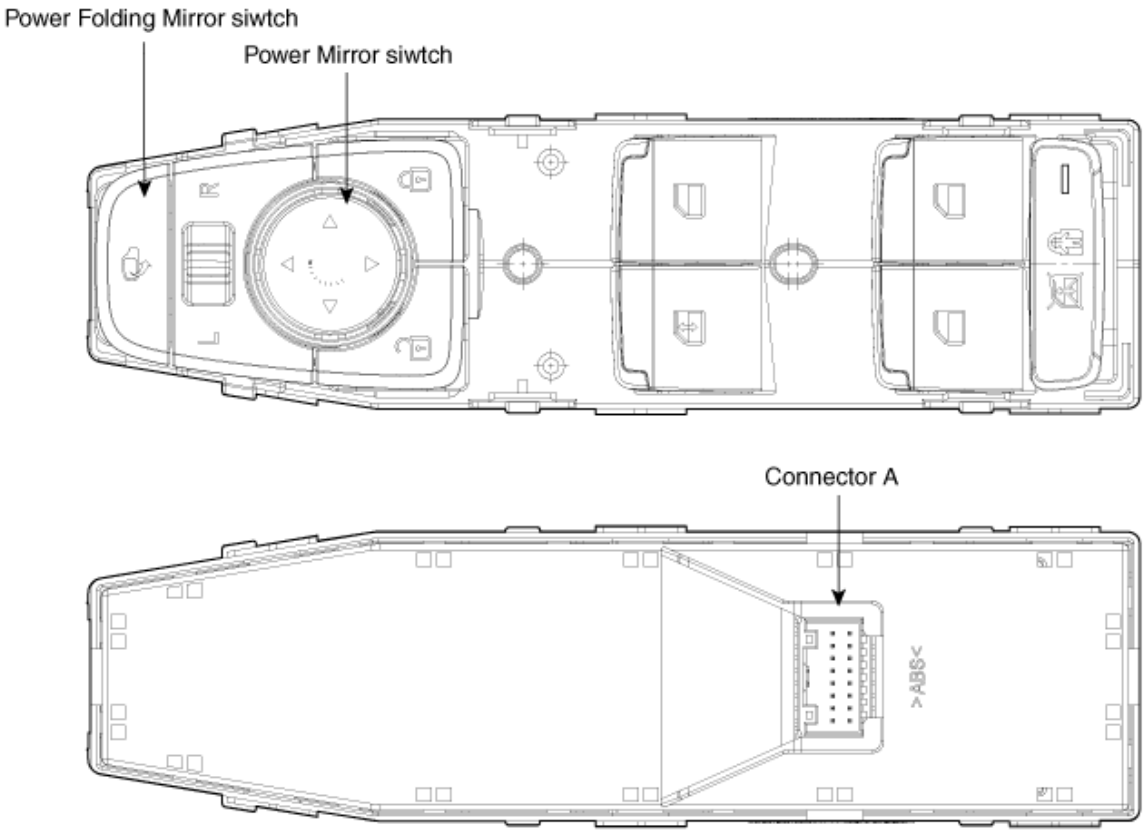
5. Connect the terminal No. 2 and No. 3 to battery voltage (12V) and check that the motor operates smoothly when connecting the terminals below.

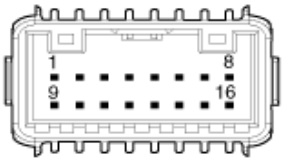
[Safety Window motor]

Position		Terminal	1	4(GND)	6
Left	Up	Counter -clockwise	○——	——○	
	Down	Clockwise		○——	——○
Right	Up	Clockwise	○——	——○	
	Down	Counter-clockwise		○——	——○

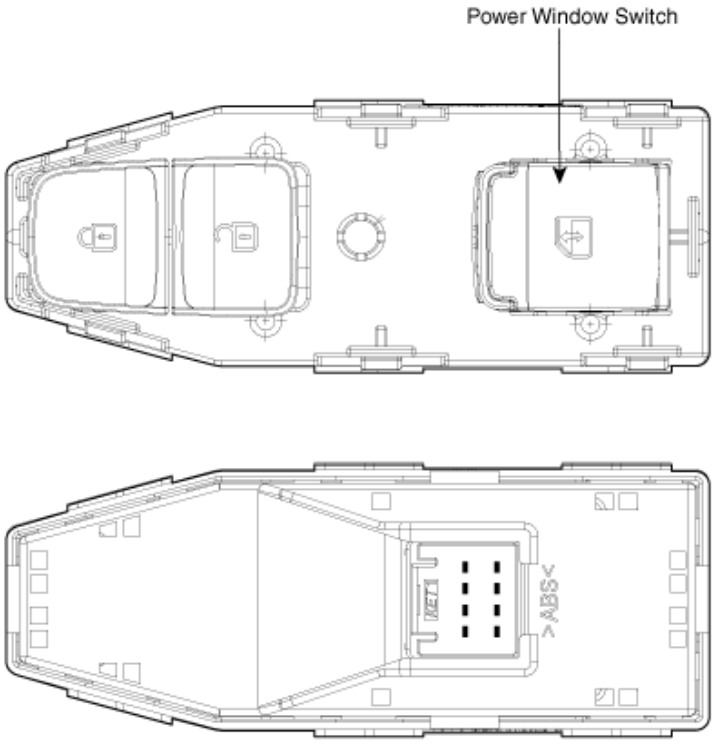
- Components

Driver Power Window Switch



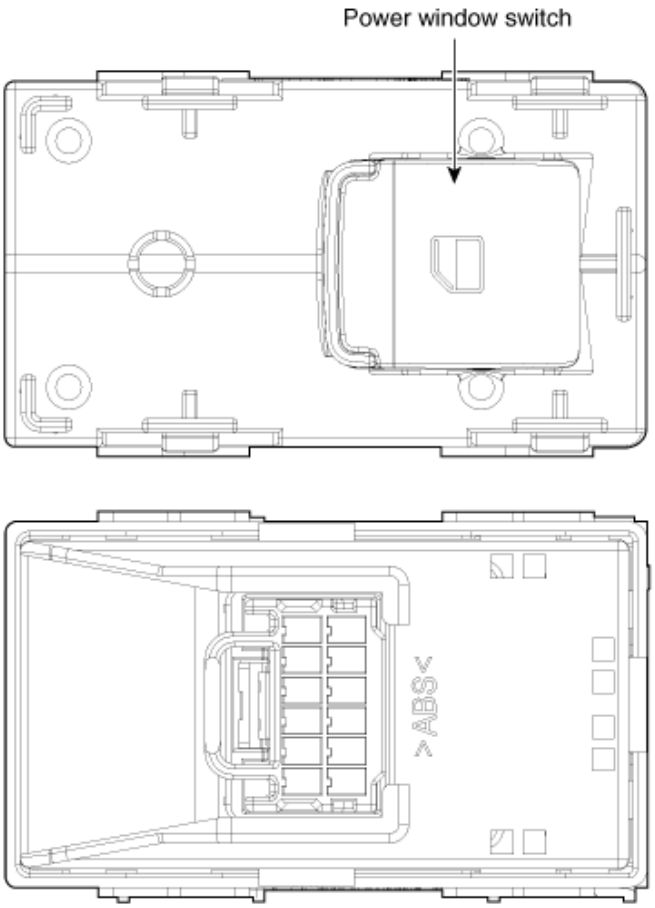
Connector A	No.	Description	No.	Description
	1	-	9	GND
	2	B_CAN (Low)	10	-
	3	B_CAN (High)	11	-
	4	-	12	IMS Switch
	5	LIN	13	-
	6	-	14	-
	7	-	15	Drive Sefety Window
	8	Battery (+)	16	IGN 1

Assist Power Window Switch



Connector A	No.	Description	No.	Description
	1	Tail lamp_GND	5	GND
	2	Door Lock Switch	6	-
	3	Door Unlock Switch	7	Safety Power Window
	4	Battery (+)	8	-

Rear Power Window Switch

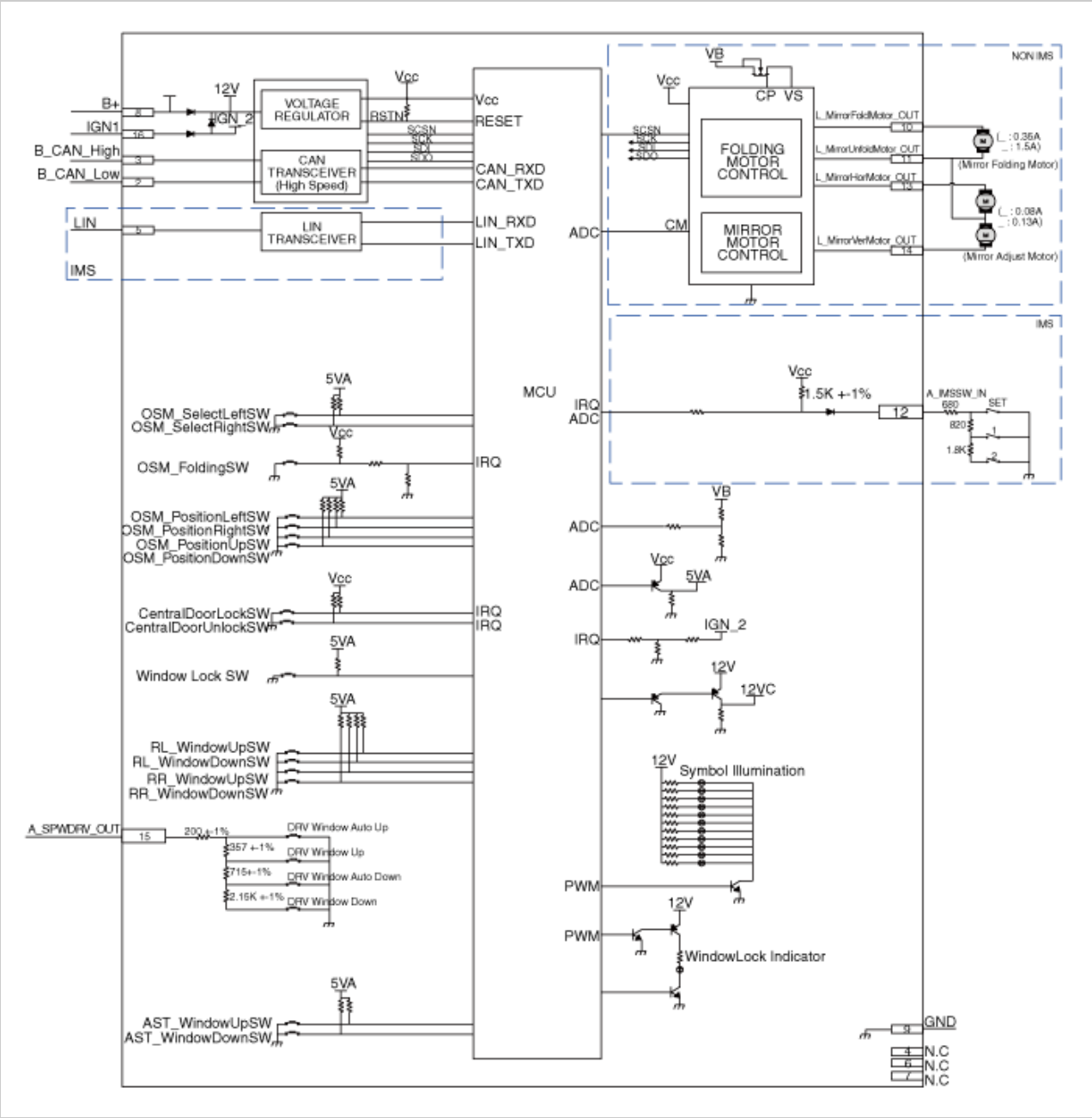


Connector A	Pin	Description	Pin	Description
	1	Ground_Illumination (-)	5	Ground
	2	-	6	-
	3	-	7	Safety power window
	4	Battery (+)_Illumination (+)	8	-

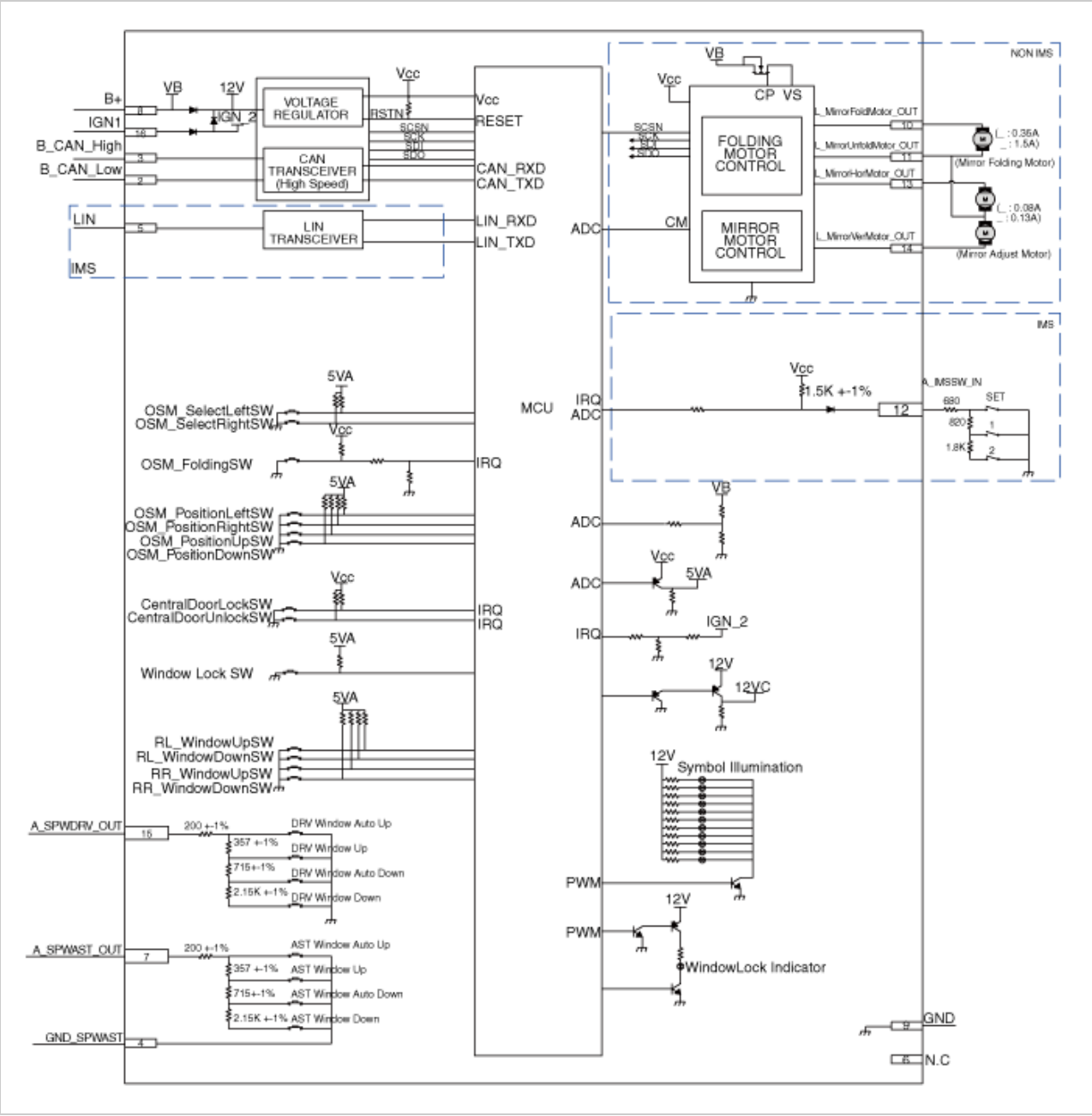
- Circuit Diagram

[Driver Power Window Switch]

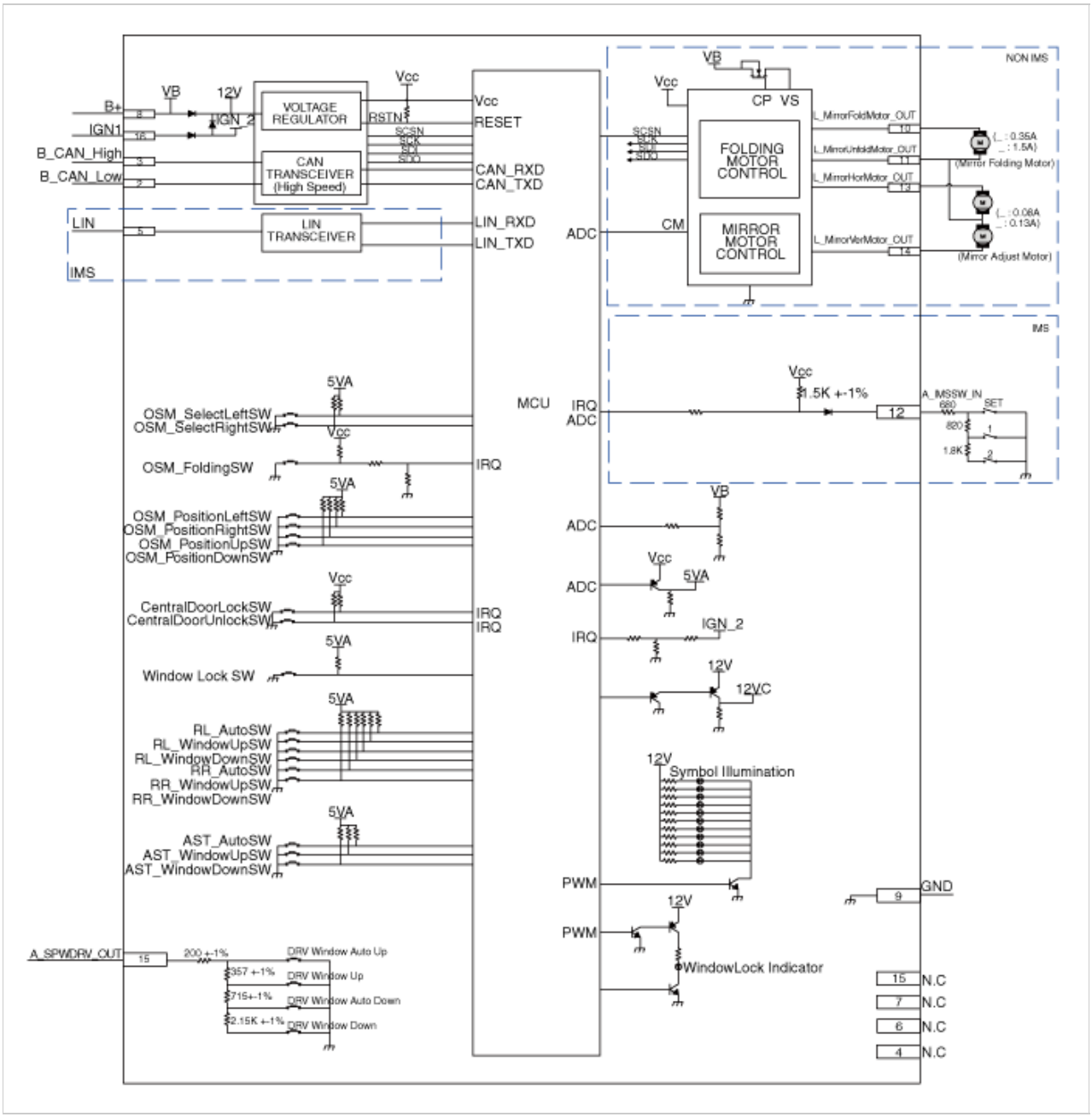
Driver safety switch



Front safety switch

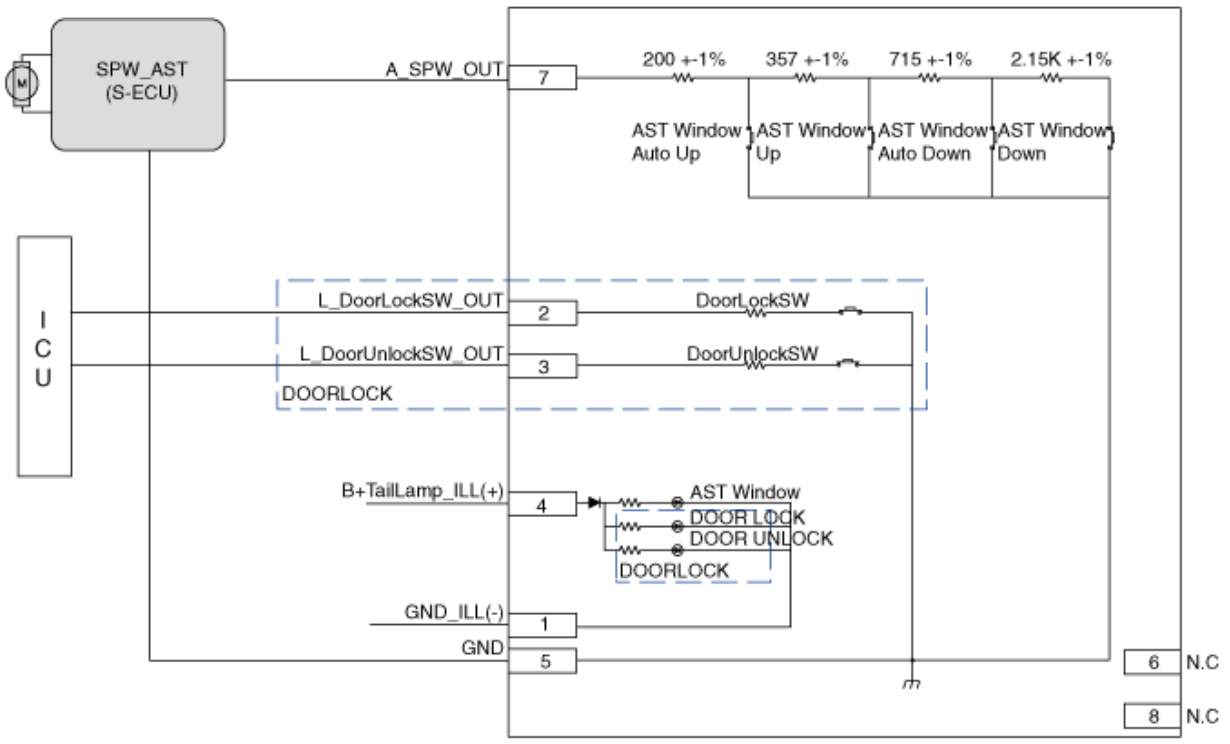


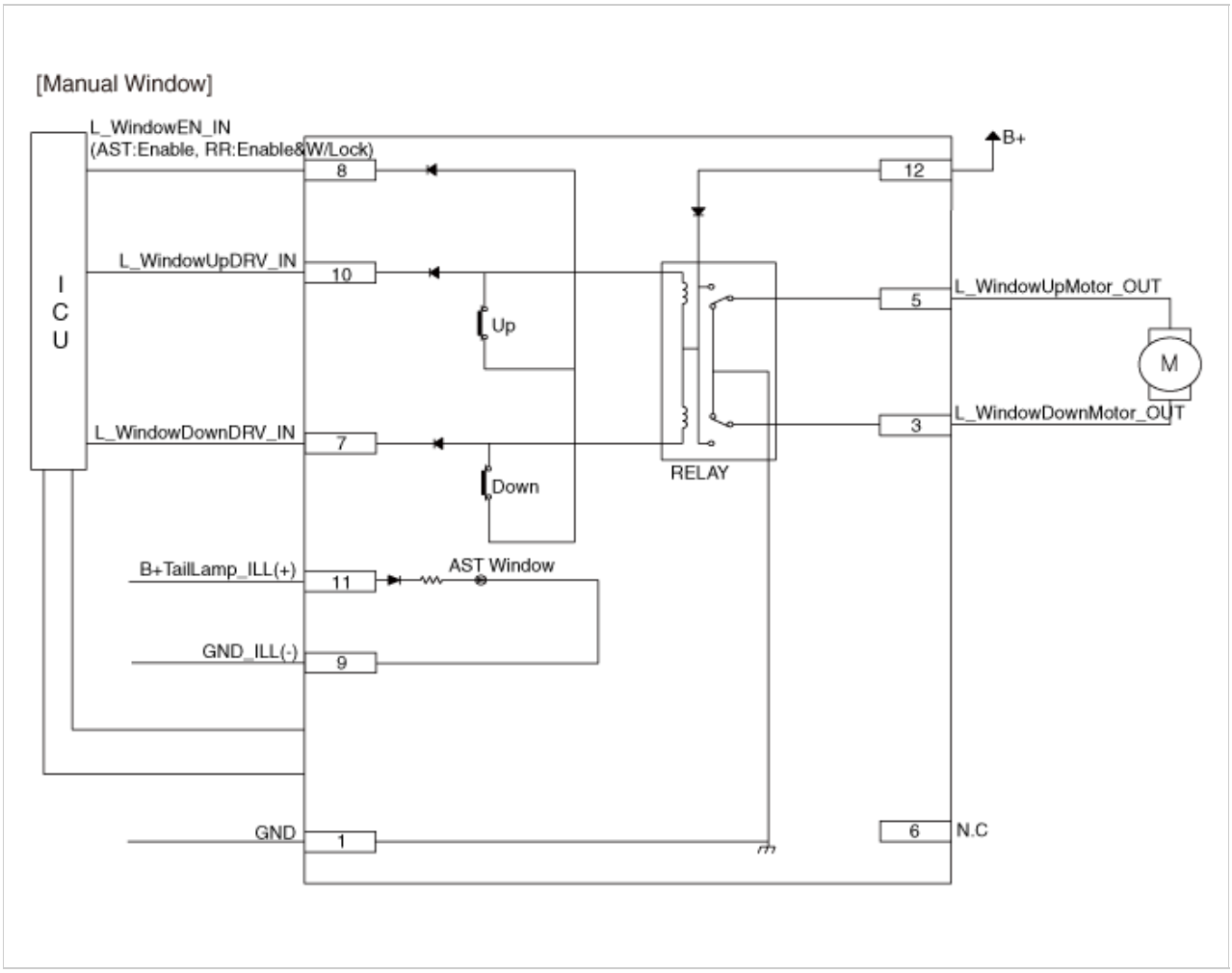
ALL safety switch



[Assist Power Window Switch]

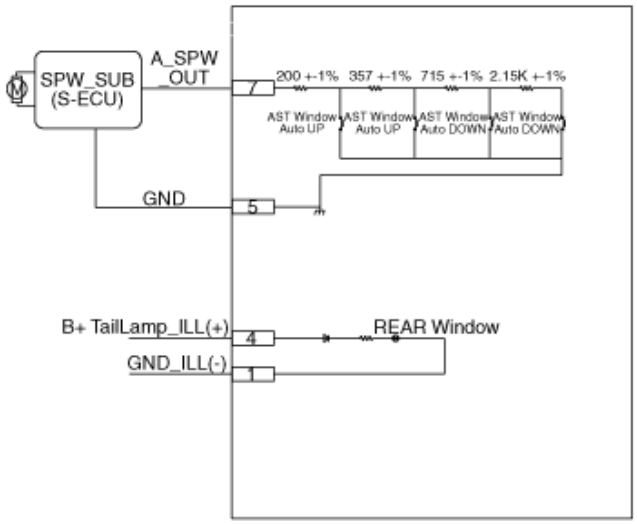
[Safety Window]



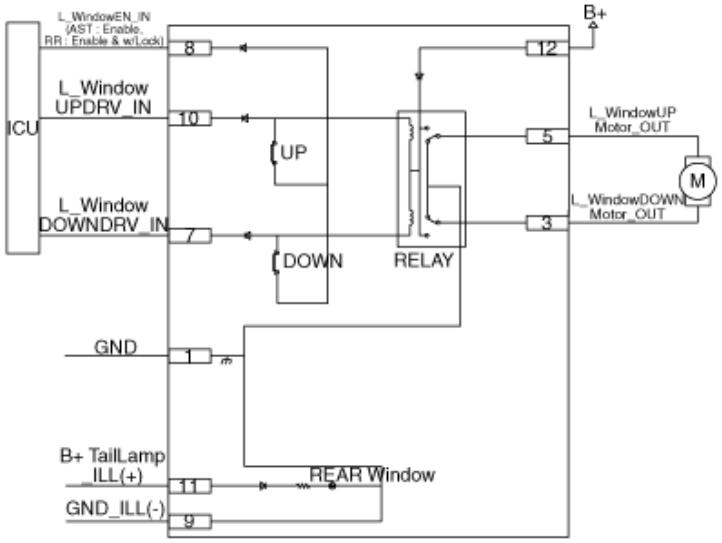


[Rear Power Window Switch]

[Safety window]



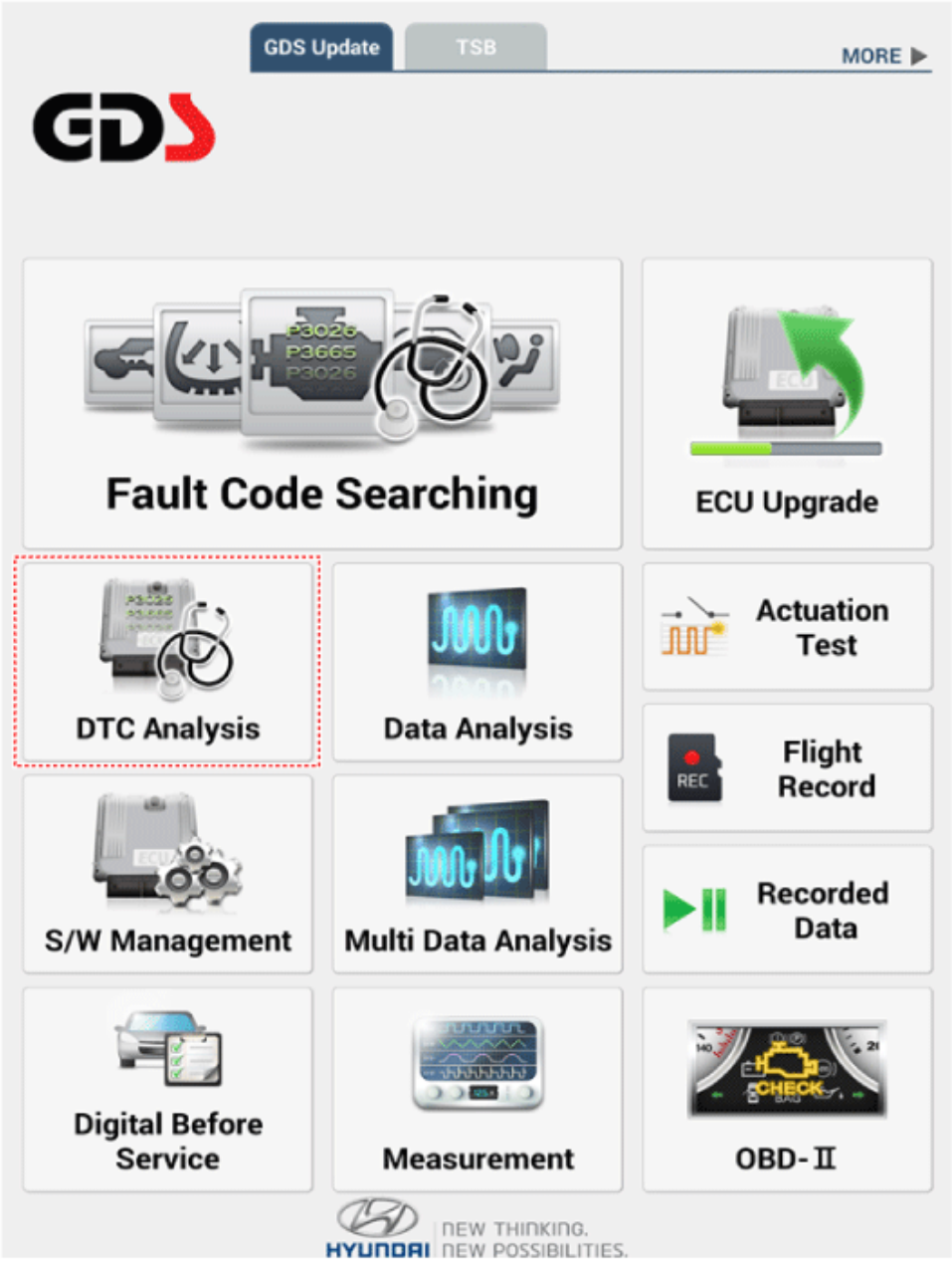
[Manual window]



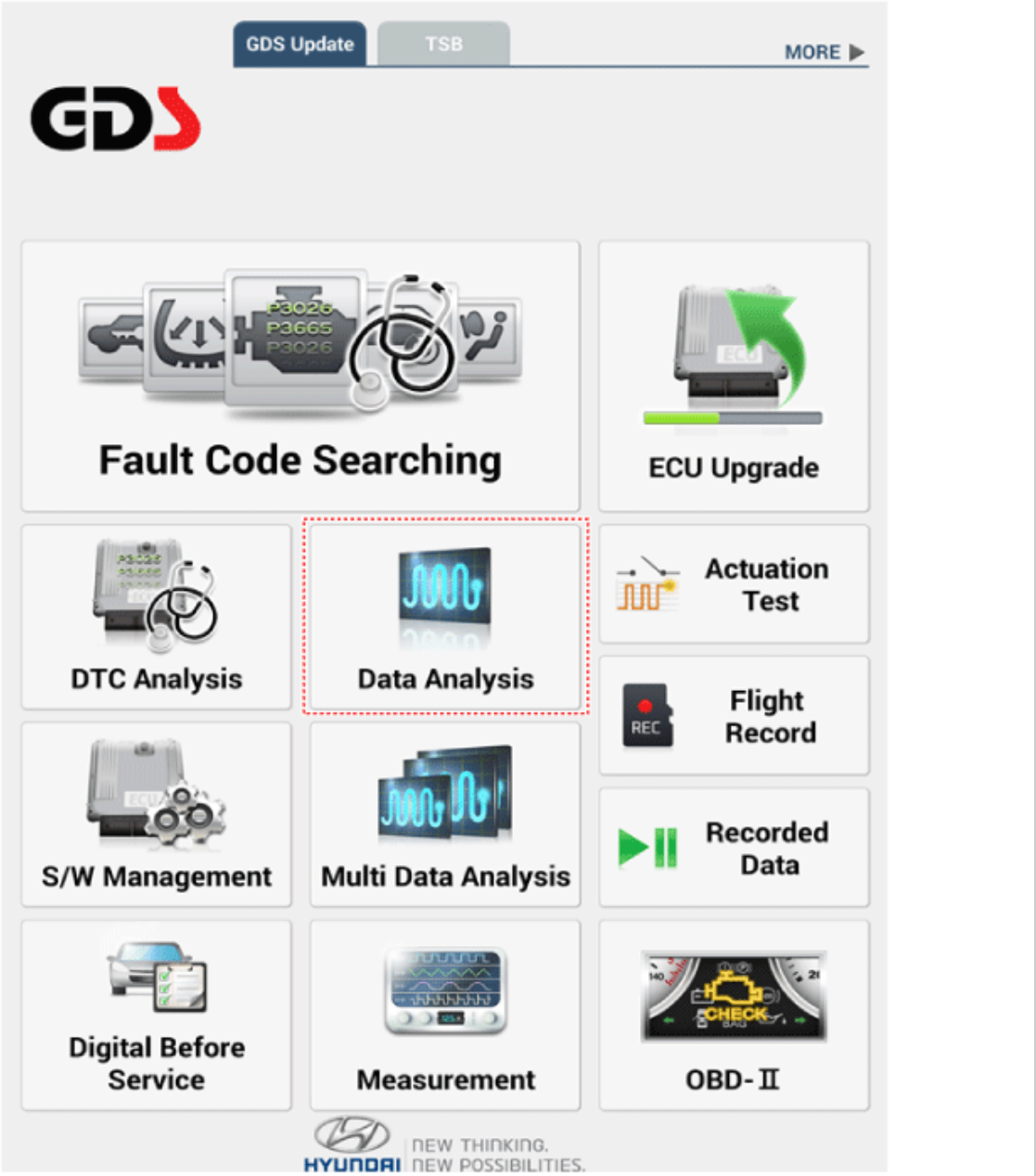
- Diagnosis with Diagnostic tool

Diagnosis with Diagnostic tool

1. In the body electrical system, failure can be quickly diagnosed by using the vehicle diagnostic system (Diagnostic tool).
   The diagnostic system (Diagnostic tool) provides the following information.
   (1) Fault Code Searching : Checking failure and code number (DTC)
   (2) Data Analysis : Checking the system input/output data state
   (3) Actuation test : Checking the system operation condition
   (4) S/W Management : Controlling other features including system option setting and zero point adjustment
2. If diagnose the vehicle by Diagnostic tool, select "DTC Analysis" and "Vehicle".

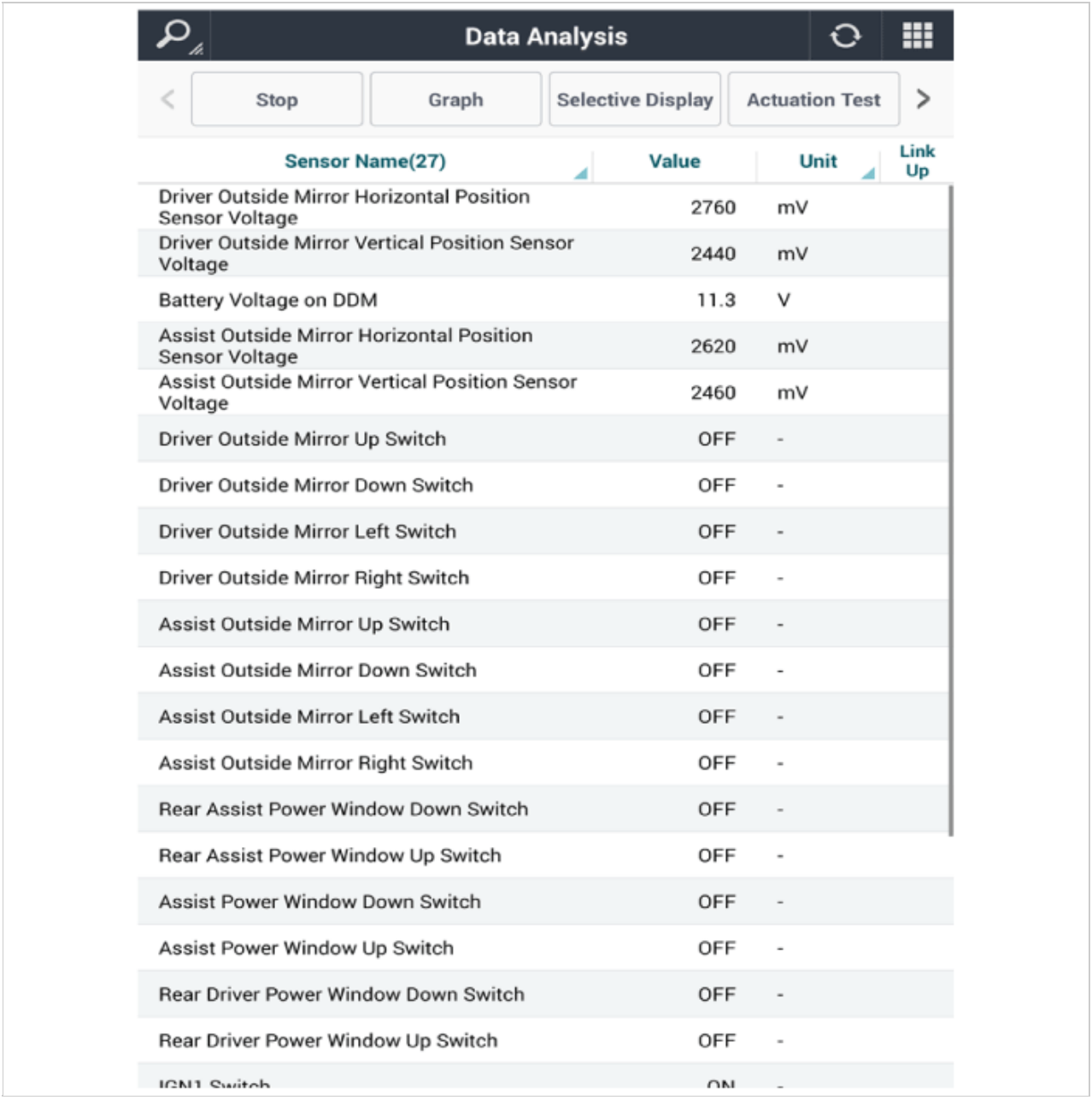


3. Select the 'Data Analysis' and 'Car model'.

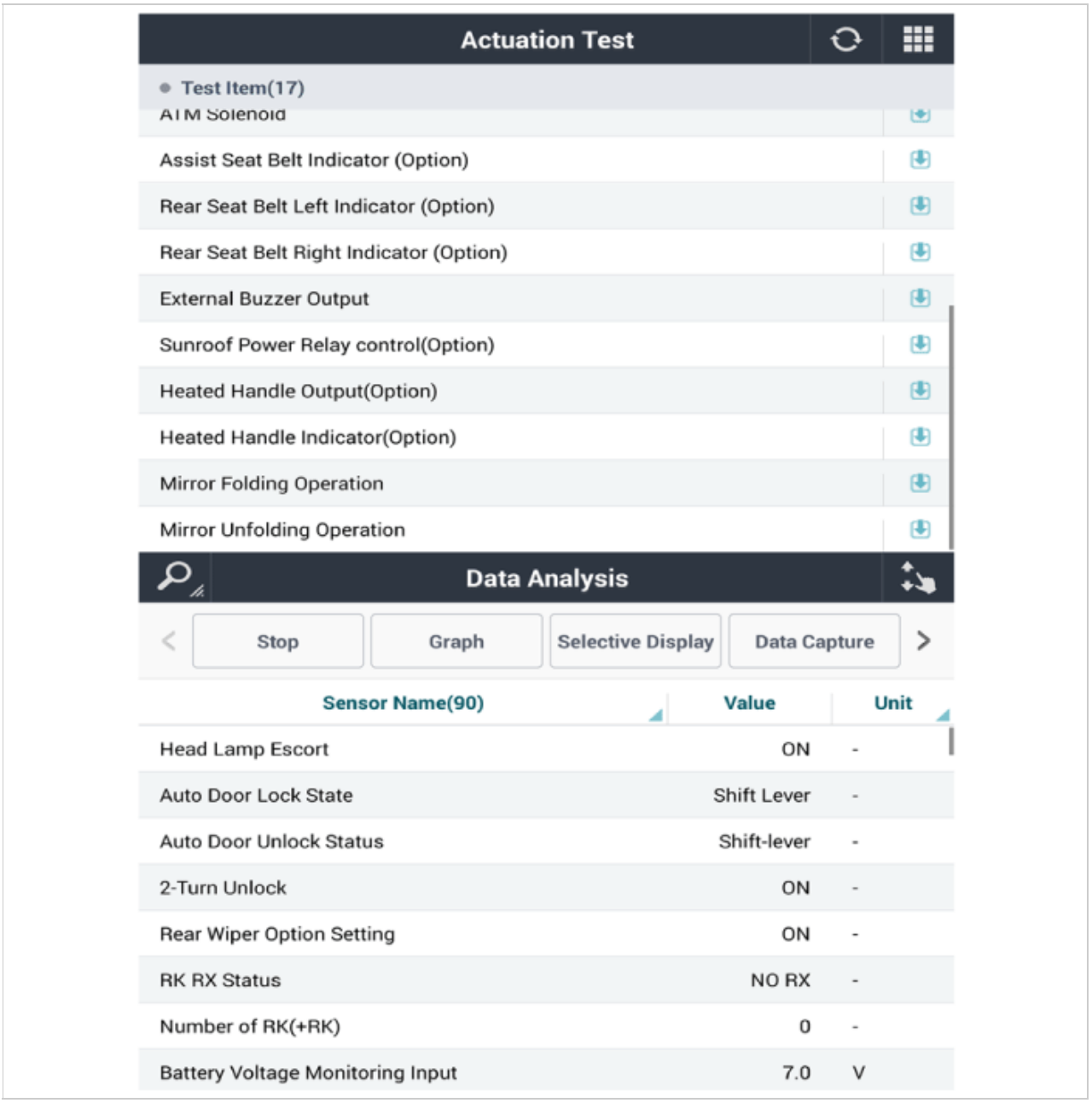


4. Select the 'DDM' to search the current state of the input/output data.

Vehicle Selection
PREV
AUTO VIN
RESET
SANTAFE(SM)
SANTAMO(M2)
D 2.2 TCI-R
System Selection
ENGINE
A / T
ABS/ESP
FCA
AIRBAG
AIRCON
4WD
EPS
RVM
SVMS
PA
BCW
FR_CMR
AFLS
AHLS
AVN
CLU
DDM
80km/h
HUD
IBU-BCM
IBU-IMMO
IBU-SMK
IBU-TPMS
PSM
System
Driver Door Module
OK



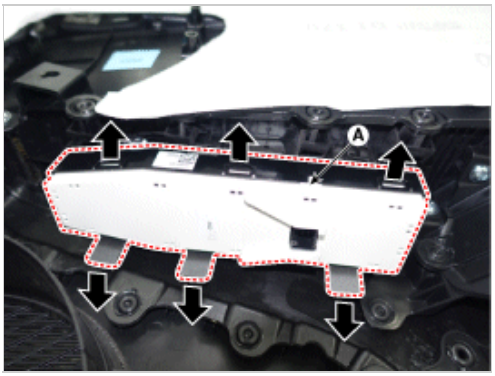
5. To forcibly actuate the input value of the module to be checked, select option 'Actuation Test'.



- Removal

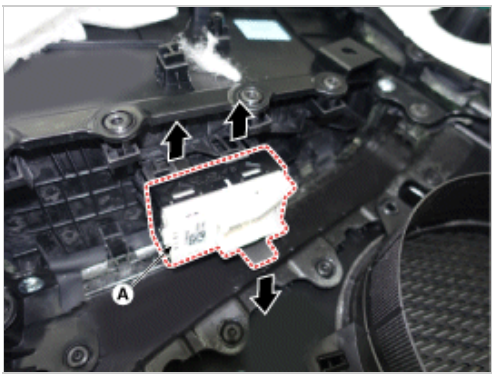
Driver Power Window Switch

1. Disconnect the negative (-) battery terminal.
2. Remove the front door trim.
   (Refer to Body - "Front Door Trim")
3. Disengage the mounting clip and then remove the power window switch assembly (A).



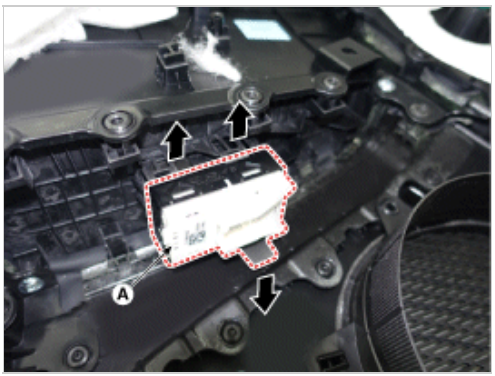
Assist Power Window Switch

1. Disconnect the negative (-) battery terminal.
2. Remove the front door trim.
   (Refer to Body - "Front Door Trim")
3. Disengage the mounting clip and then remove the power window switch assembly (A).



Rear Power Window Swtich

1. Disconnect the negative (-) battery terminal.
2. Remove the rear door trim.
   (Refer to Body - "Rear Door Trim")
3. Disengage the mounting clip and then remove the power window switch assembly (A).



- Installation

Driver Power Window Switch

1. Install the power window switch assembly.
2. Install the front door trim after connecting the connector.

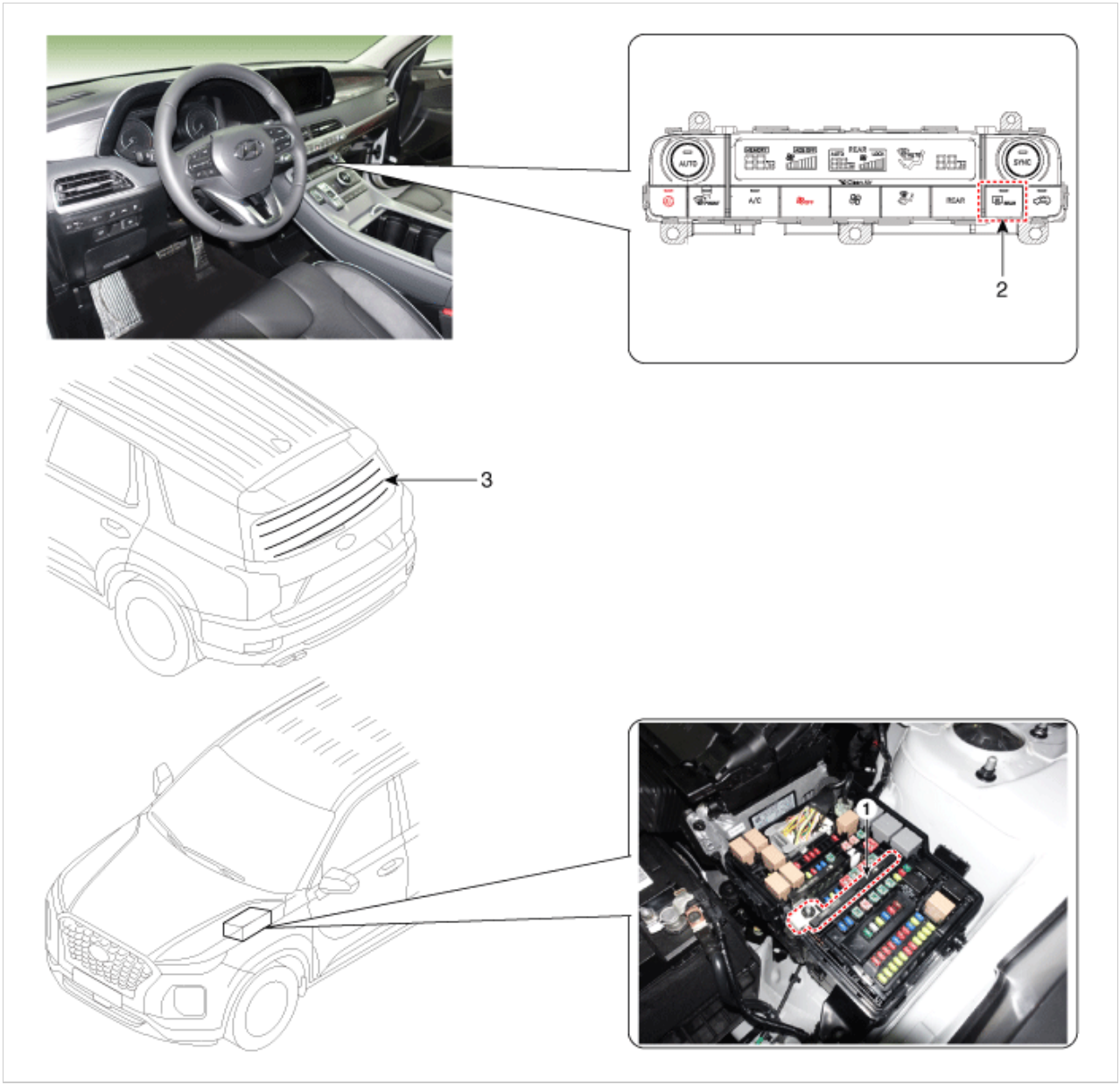
Assist Power Window Switch

1. Install the power window switch assembly.
2. Install the front door trim after connecting the connector.

Rear Power Window Swtich

1. Install the power window switch assembly.
2. Install the rear door trim after connecting the connector.

- Component Location

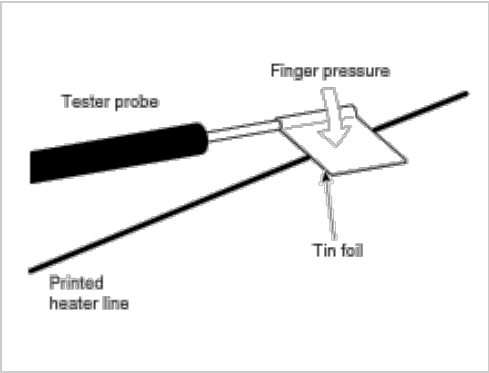


1. Rear glass defogger relay (Buil-in engine room relay box)
2. Rear glass defogger switch (Dual type)
3. Rear glass defogger

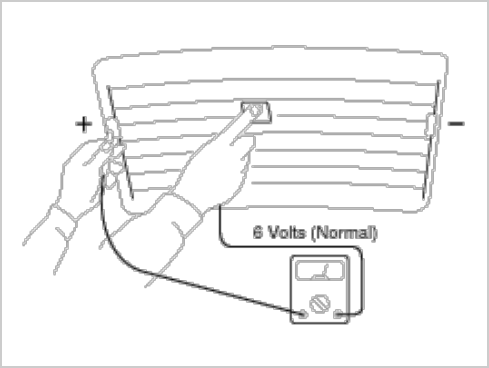
- Inspection

CAUTION

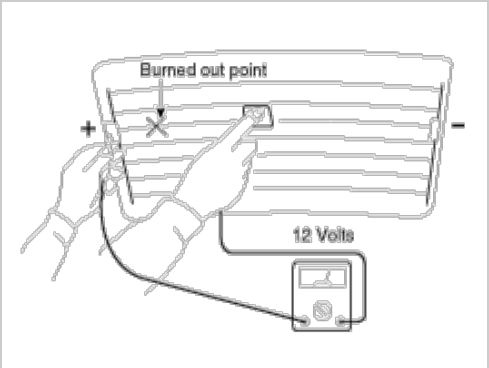
Wrap tin foil around the end of the voltmeter test lead to prevent damaging the heater line. Apply finger pressure on the tin foil, moving the tin foil along the grid line to check for open circuits.



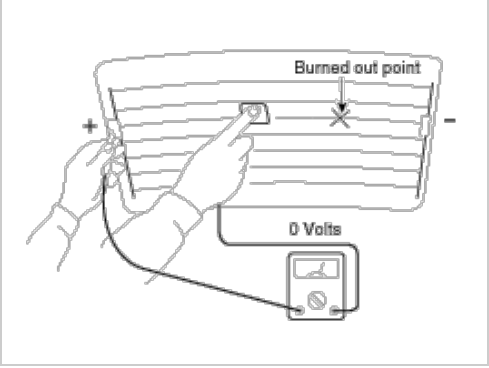
1. Turn on the defogger switch and use a voltmeter to measure the voltage of each heater line at the glass center point. If a voltage of approximately 6V is indicated by the voltmeter, the heater line of the rear window is considered satisfactory.



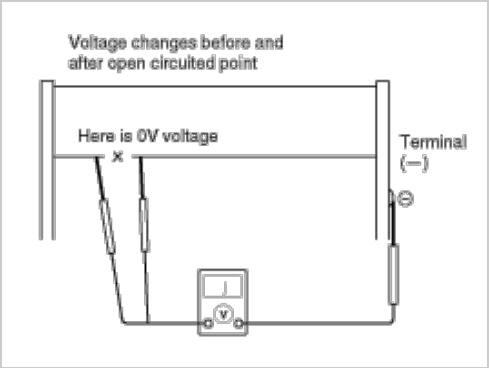
2. If a heater line is burned out between the center point and (+) terminal, the voltmeter will indicate 12V.



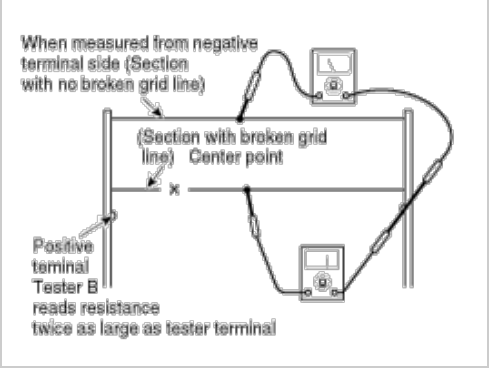
3. If a heater line is burned out between the center point and (-) terminal, the voltmeter will indicate 0V.



4. To check for open circuits, slowly move the test lead in the direction that the open circuit seems to exist. Try to find a point where a voltage is generated or changes to 0V. The point where the voltage has changed is the open-circuit point.



5. Use an ohmmeter to measure the resistance of each heater line between a terminal and the center of a grid line, and between the same terminal and the center of one adjacent heater line. The section with a broken heater line will have a resistance twice that in other sections. In the affected section, move the test lead to a position where the resistance sharply changes.

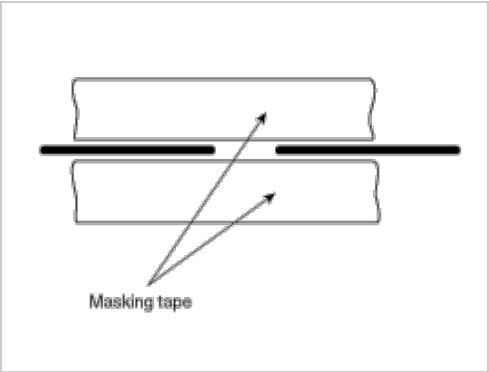


Repair Of Broken Heater Line

Prepare the following items :

1. Conductive paint.
2. Paint thinner.
3. Masking tape.
4. Silicone remover.
5. Using a thin brush :

   Wipe the glass adjacent to the broken heater line, clean with silicone remover and attach the masking tape as shown. Shake the conductive paint container well, and apply three coats with a brush at intervals of about 15 minutes apart. Remove the tape and allow sufficient time for drying before applying power. For a better finish, scrape away excess deposits with a knife after the paint has completely dried. (Allow 24 hours).



- Diagnosis with Diagnostic tool

Diagnosis with Diagnostic tool

1. In the body electrical system, failure can be quickly diagnosed by using the vehicle diagnostic system (Diagnostic tool).
   The diagnostic system (Diagnostic tool) provides the following information.

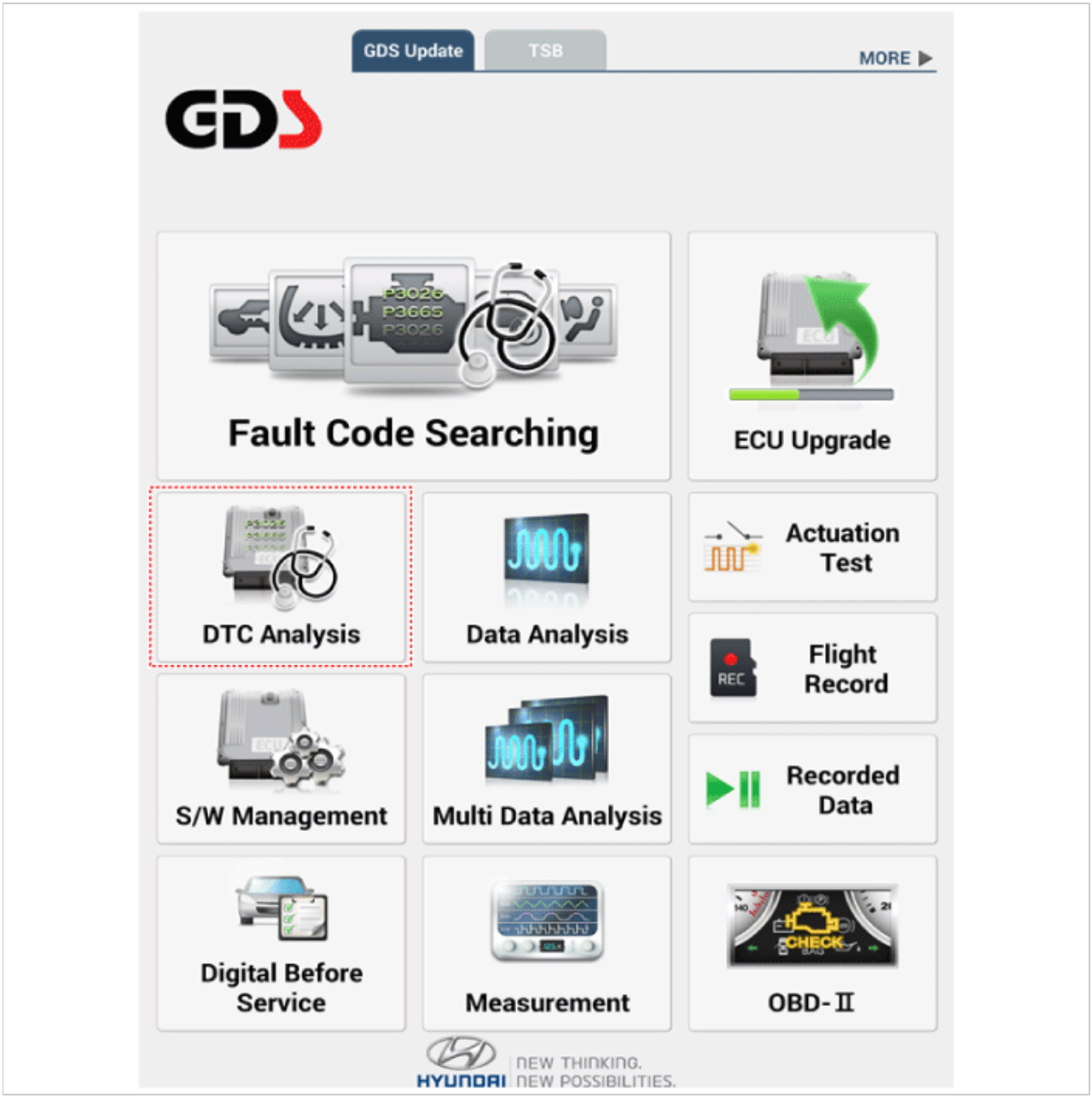
(1) Fault Code Searching : Checking failure and code number (DTC)

(2) Data Analysis : Checking the system input/output data state

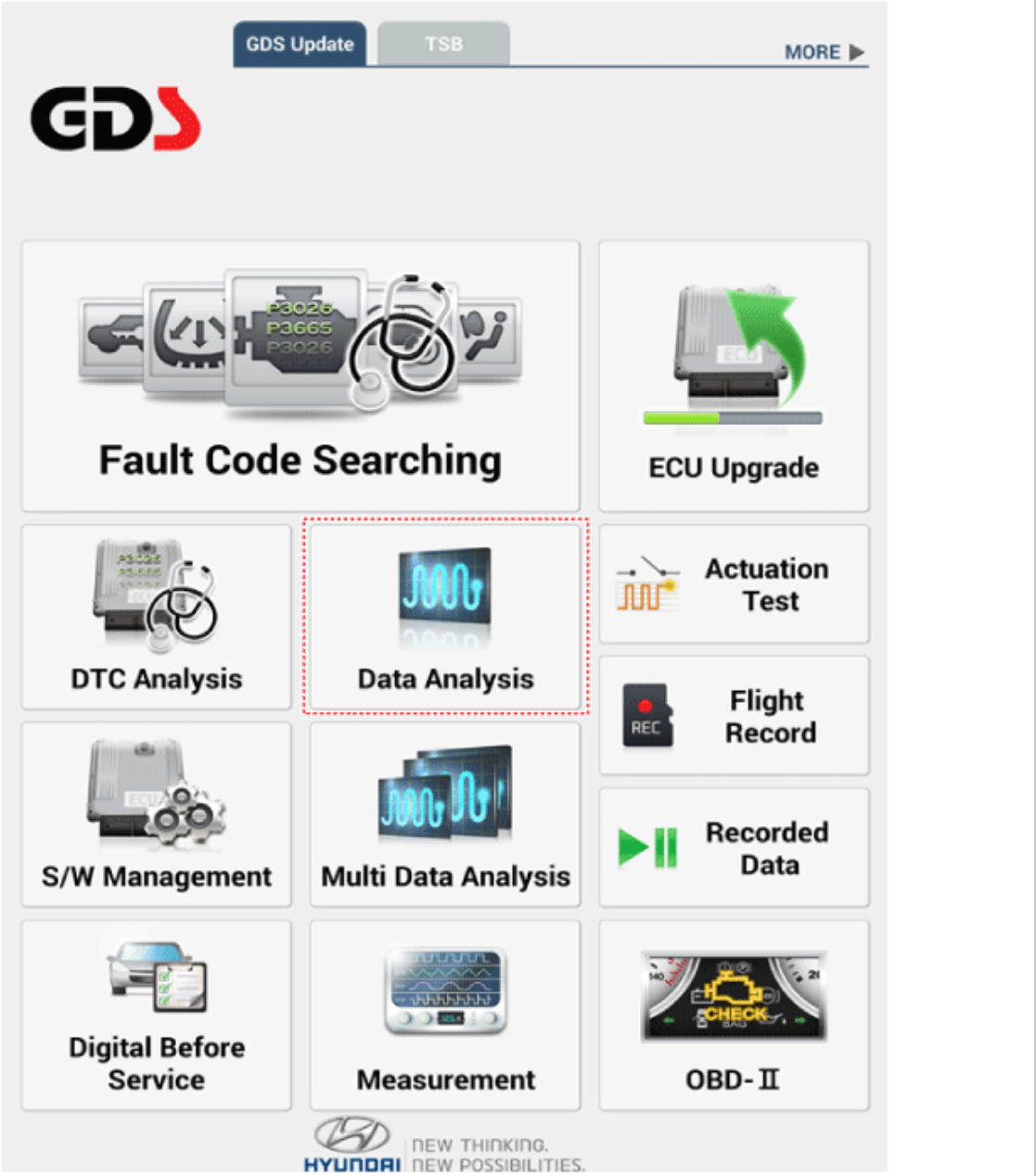
(3) Actuation test : Checking the system operation condition

(4) S/W Management : Controlling other features including system option setting and zero point adjustment

2. If diagnose the vehicle by Diagnostic tool, select "DTC Analysis" and "Vehicle".

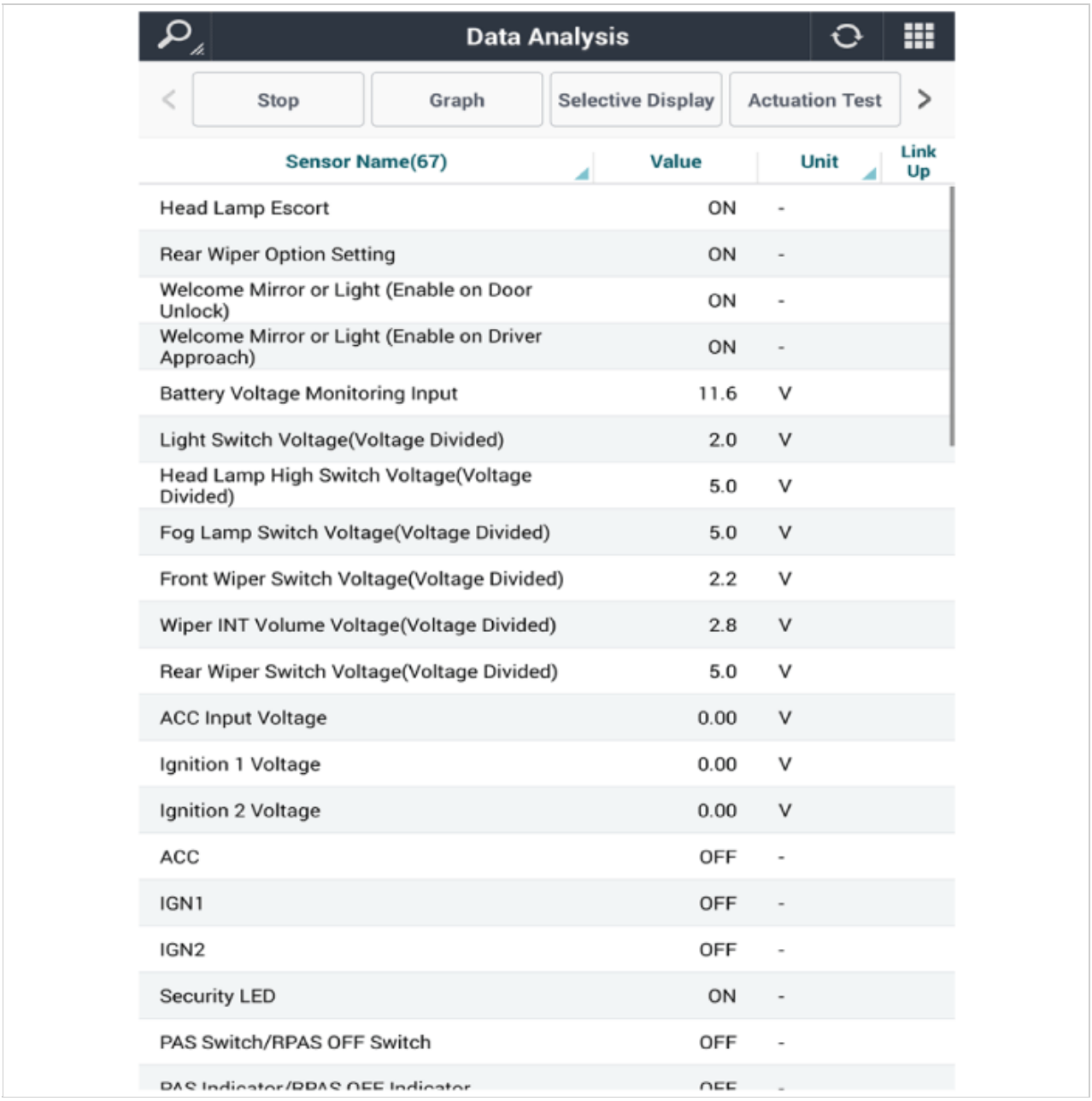


3. Select the 'Data Analysis' and 'Car model'.

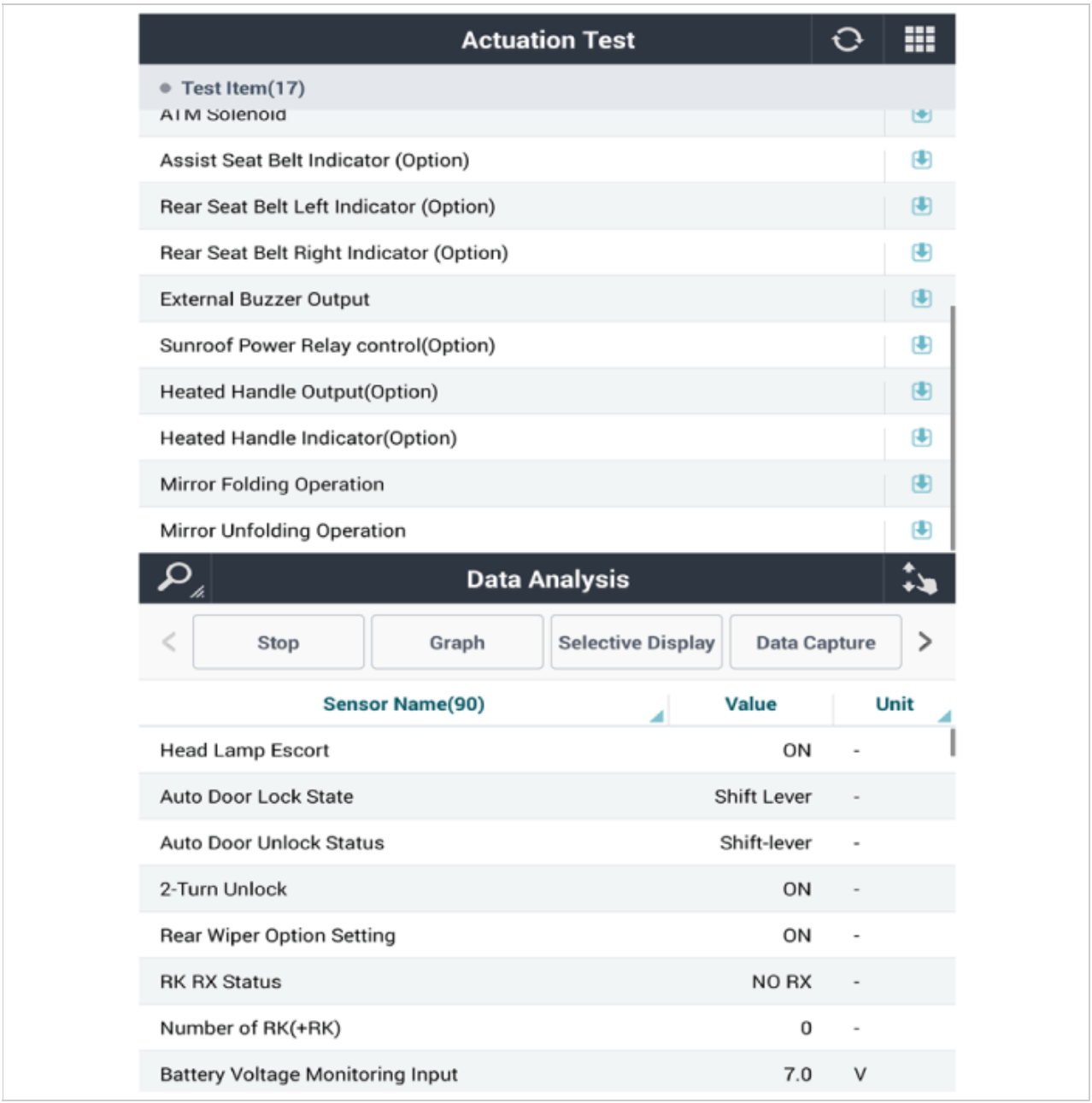


4. Select the 'IBU_BCM' to search the current state of the input/output data.

Vehicle Selection
PREV
AUTO VIN
RESET
SANTAFE(SM)
SANTAMO(M2)
D 2.2 TCI-R
System Selection
ENGINE
A / T
ABS/ESP
FCA
AIRBAG
AIRCON
4WD
EPS
RVM
SVMS
PA
BCW
FR_CMR
AFLS
AHLS
AVN
CLU
DDM
80km/h
HUD
IBU-BCM
IBU-IMMO
IBU-SMK
IBU-TPMS
PSM
System
IBU-BCM
OK


Data Analysis
Stop
Graph
Selective Display
Actuation Test
Sensor Name(67)
Value
Unit
Link Up
Head Lamp Escort ON -
Rear Wiper Option Setting ON -
Welcome Mirror or Light (Enable on Door Unlock) ON -
Welcome Mirror or Light (Enable on Driver Approach) ON -
Battery Voltage Monitoring Input 11.6 V
Light Switch Voltage(Voltage Divided) 2.0 V
Head Lamp High Switch Voltage(Voltage Divided) 5.0 V
Fog Lamp Switch Voltage(Voltage Divided) 5.0 V
Front Wiper Switch Voltage(Voltage Divided) 2.2 V
Wiper INT Volume Voltage(Voltage Divided) 2.8 V
Rear Wiper Switch Voltage(Voltage Divided) 5.0 V
ACC Input Voltage 0.00 V
Ignition 1 Voltage 0.00 V
Ignition 2 Voltage 0.00 V
ACC OFF -
IGN1 OFF -
IGN2 OFF -
Security LED ON -
PAS Switch/RPAS OFF Switch OFF -

5. To forcibly actuate the input value of the module to be checked, select option 'Actuation Test'.



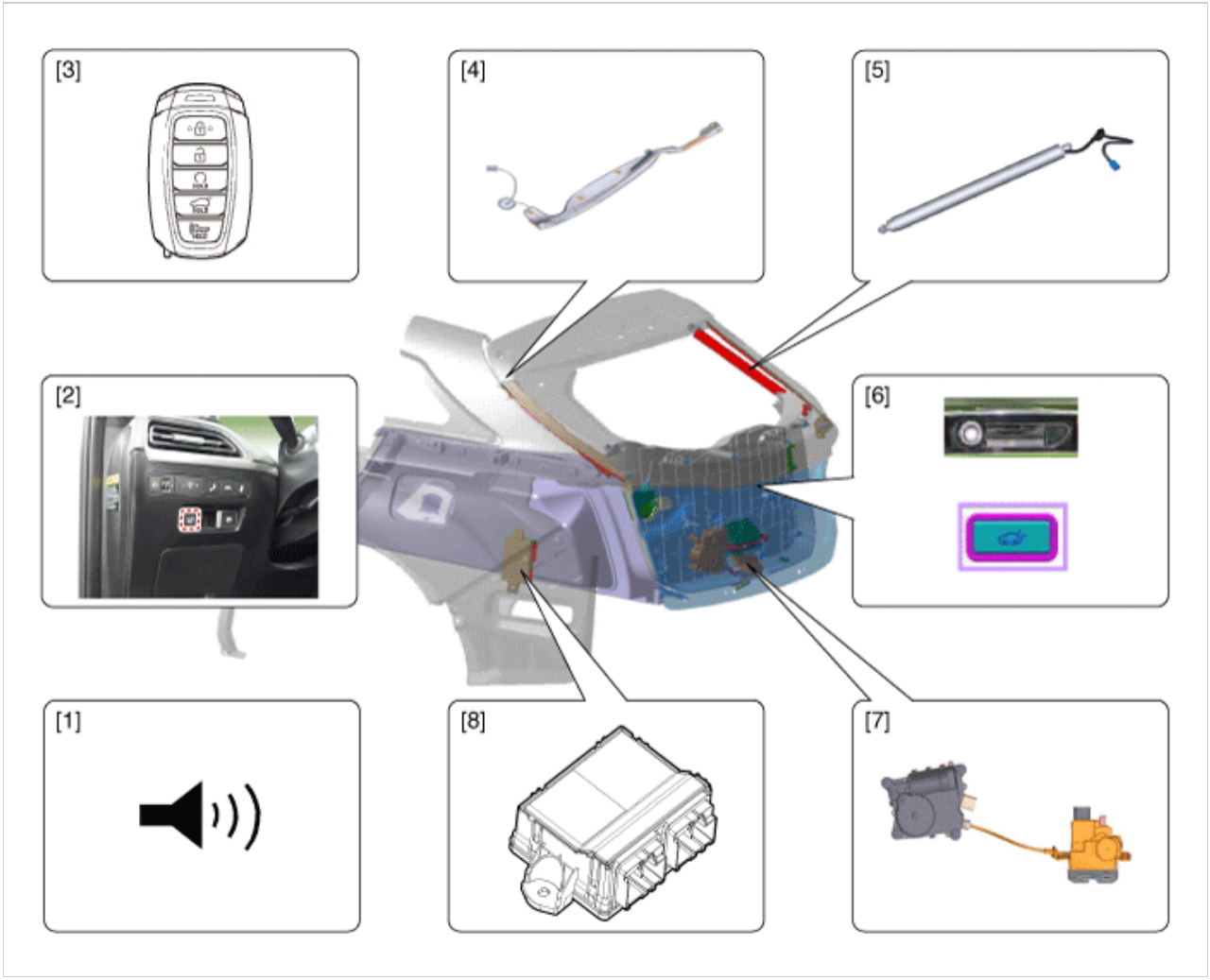
- Removal

1. Disconnect the negative (-) battery terminal.
2. Remove the audio unit or the AVN head unit.
   (Refer to Audio - "Audio Unit")
   (Refer to AVN System - "AVN Head Unit")
3. Remove the heater and A/C controll unit.
   (Refer to Heating, Ventilation, Air Conditioning - "Heater & A/C Control Unit (Manual)")
   (Refer to Heating, Ventilation, Air conditioning - "Heater & A/C Control Unit (DATC)")

- Installation

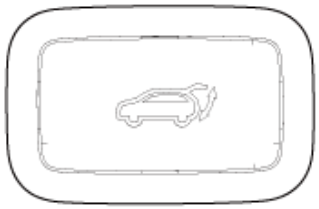
1. Install the heater and A/C control unit.
2. Install the audio unit or the AVN head unit.
3. Connect the negative (-) battery terminal.

- Component Location (1)



1. Buzzer
2. Power tailgate switch
3. FOB key
4. Anti Pinch Strip
5. Spindle Drive
6. Tailgate Trim Switch
7. Power Latch
8. PTG Control Module

[Tail Gate Inner Switch]



Terminal / Position	ON(PUSH)	OFF(FREE)	Remark
1			ILL (+)
3			ILL (-)
4			PTG
6			GND

- Description

Power tailgate is an electro-mechanical system designed to provide power opening and closing of the tailgate through the push of a button of a remote key (fob), console switch, inner switch or an outside handle switch of the tailgate.

The power tailgate will reverse direction of travel if resistance to movement is detected while the tailgate is being opened or closed.

Tailgate Position And Direction

The PTG system will measure the Tailgate position via an integrated hall sensor inside the Spindle drive unit motor.

The moving direction of tailgate will be detected by analyzing the direction of the drive unit motor.

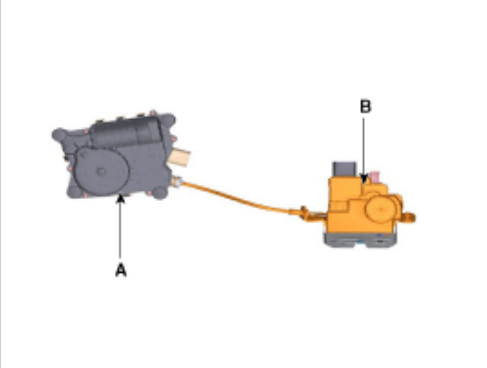
The hall sensor pulse counting (position detection) is active during power and manual operation mode.

System Components

1. PTG Unit

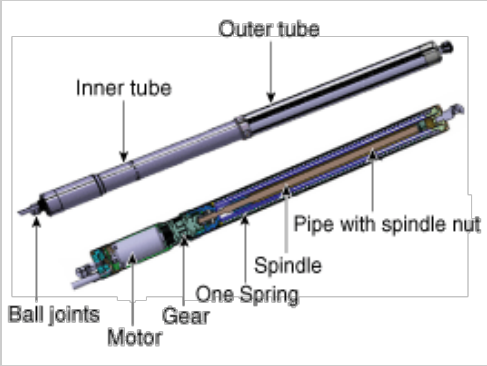
PTG unit is located in rear left luggage side trim.
PTG drive unit drive the two actuators (Spindles) by measuring the driving motors.
PTG unit also controls anti trap functions by hall sensor analysis in the anti-pinch strip.

2. PTG Latch Assembly



PTG latch assembly is consist of Power Latch (A) and Power Closeing Unit (B).
Power latch is located in the lower part of tail gate panel.

3. PTG Spindle



PTG spindle open and close the tailgate by driving the motor.

4. Anti-Pinch Strip

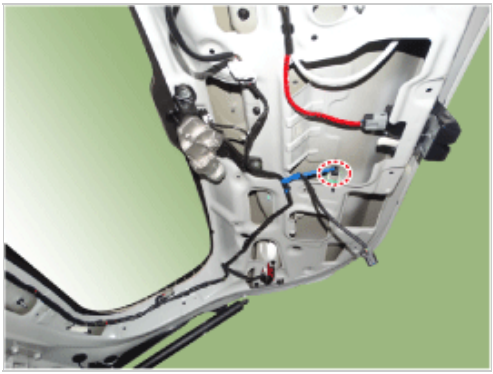
During power closing or cinching, the PTG system shall reverse to full open if an anti-pinch strip signal is received. However, the anti-pinch strips will not work when the Tailgate is idle in the full closed, full open, or stopped positions.

5. SMK (Smart key)

Push the power tailgate open of the SMK more than 0.5s to open the power tailgate. Power Open operation shall be reversed when an additional Open/Close signal is received during power opening.

6. Tailgate inner switch

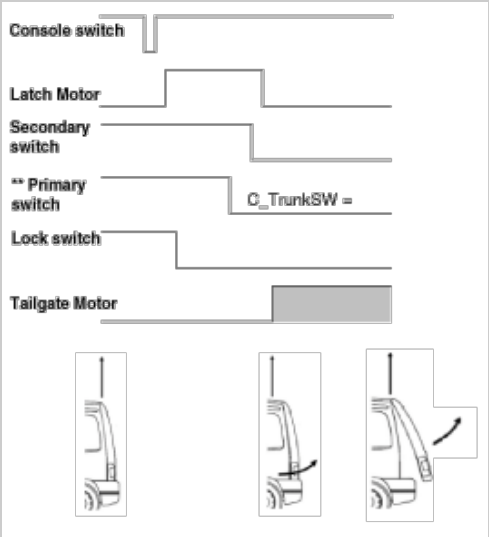
7. Tailgate buzzer



When a power operation cannot be performed as requested or an obstacle has been detected.

- Operation

Power Tailgate Opening



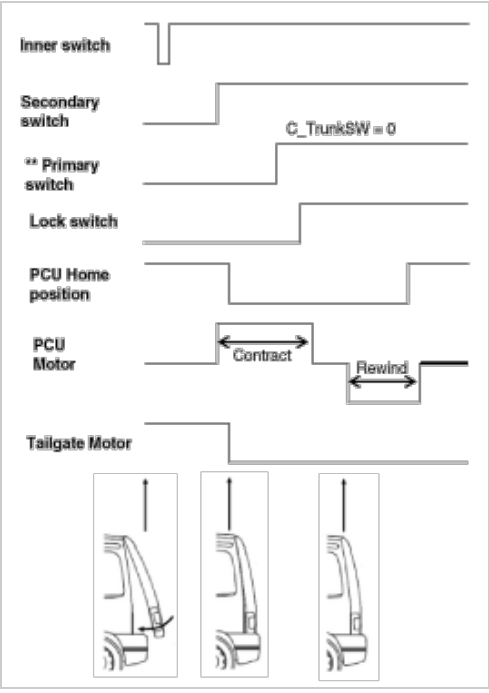
** - Primary switch signal received by PTGM via CAN bus (sent by SJB)

PTGM Opening procedure :

1. Opening can be triggered after a signal is received from, driver-console switch, outside handle switch, remote Key (FOB)
2. The latch will be released (by SJB) by actuation of latch motor.
3. On latch release, the tailgate latch pops out of the striker.
4. PTG module controls the tailgate motor in order to open the tailgate.
5. The rotating speed of the tailgate motor can be hall sensor that is built in the motor.
6. Opening angle of the tailgate is calculated by counting the input pulse signals from Hall sensor.

> **NOTICE**
> When the motor movement is restricted, the PTGM stops the tailgate motor movement due to obstacle detection.

Power Tailgate Closing

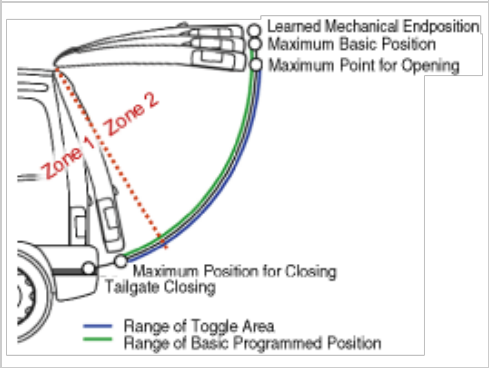


PTGM Closing procedure :

1. Closing can be triggered after receiving a signal from, console (driver) switch, ouside handle switch, remote key (FOB), inner switch

2. PTG module controls the tailgate motor in order to close the tailgate
3. Closing angle of the tailgate is calculated by counting the input pulse signlas from hall sensor
4. The rotating speed of the tailgate motor can be hall sensor that is built in the motor
5. The tailgate latch engages with the striker and the latch is locked mechanically (Latch unlock → Latch lock)
6. PTGM stops the tailgate motor operation after detecting the tailgate latch's secondary signal
7. On detecting the latch's secondary signal, the power close unit (PCU) starts the contract (cinch) operation and stops after the latch lock signal is detected
8. After contract operation is stopped, PCU is rewound until the PCU home position is reached
9. The tailgate is completely closed and latch is fully locked

Learned/Calculated/Programmed positions



1. Maximum Point for Opening

   Above this position a start in opening direction could make the tailgate move beyond the Maximum Basic Position and overload the mechanical system (hinges).

   Therefore the start of an opening action above this point is disabled.

   Anyway the tailgate moves beyond this point, if it has been started at a lower position.

2. Learned Mechanical End Position

   This is the mechanical block position while opening and is considered to be 100% opening. During the first tailgate opening this position is learned.

   After learning, the tailgate will not move beyond the Maximum Basic Position, which is defined by the Learned Mechanical Position – Security Distance.

   All positions are defined by parameters in the ECU or programmed by the user (Basic Programmed Position)

Programming the max. T/gate opening (Garage Position)

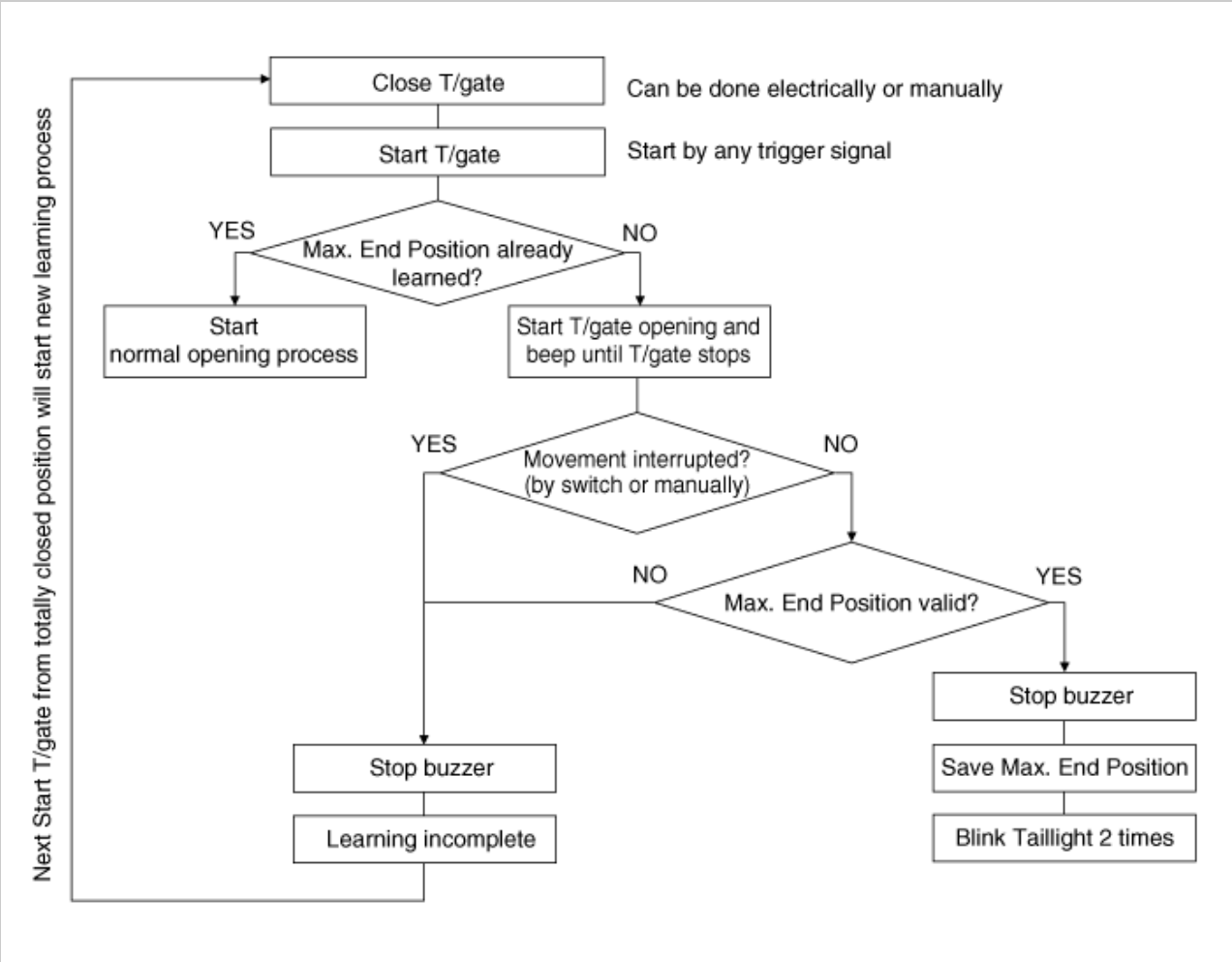
1. The customizable Programmed Basic Position is set equal to the Maximum Basic Position after the Learned Mechanical End Position is learned.
   - The customer can change the Programmed Basic Position to any new position between the Maximum Point For Closing and the Maximum Basic Position.
   - If the customer wants to set a new Programmed Basic Position below the actual Programmed Basic Position, he has to move the tailgate electrically or manually to the new position and has to push the Inner Switch for e.g. 3 seconds (time can be modified by parameter)
   - If the customer wants to set a new Programmed Basic Position above the actual Programmed Basic Position he has to move the tailgate manually to the new position and has to push the Inner Switch for 5 seconds (time can be modified by parameter)
   - If the user tries to program a tailgate position above the Maximum Basic Position, the ECU will set the Programmed Basic Position to the Maximum Basic Position.

System Parameterization

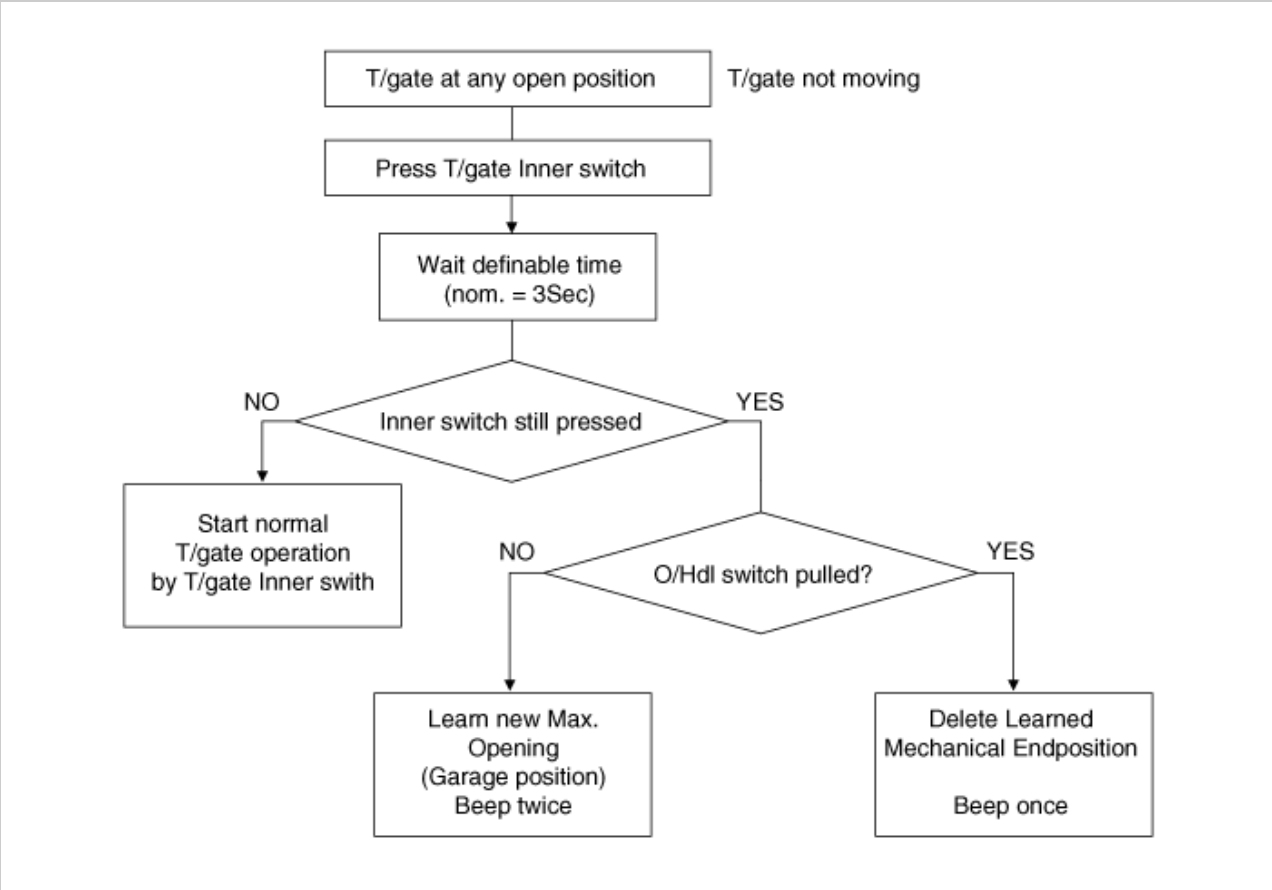
Due to mechanical tolerances and adjustments in vehicle production and assembly the power operated tailgate needs calibration of the maximum movement range before proper operation can be ensured.

The tailgate's maximum movement range is represented by the number of Hall-pulses received by the ECU from the actuators' speed / position sensors during a tailgate movement from the fully closed position (closure unit in fully latched position) to the upper end position limited by mechanical constraints (e.g. upper bump stops, spindle length or similar).

Calibration Mode



Manual De-calibration Mode



Buzzer operation is defined in the following chart

	BUZZER	LAMP *)	Remark
T/gate start	2 times	2 times	When T/gate is triggered by Remote Contol or T/gate Console Switch
T/gate start	n.a.	n.a.	When T/gate is triggered by T/gate Inner Switch or T/gate Outer Handle Switch
T/gate stop	n.a.	n.a.	
System error	3 Times	-	PCU/Tailgate antiplay active, 0ver-/undervoltage condition, Endposition-/position error, spindle error, CAN error, Latch closed when Tailgate open
T/gate not closed	10 times	10 times	Latch Lock Switch not present
During Calibration run	Continuous ON-OFF beeping	n.a.	Activate buzzer but not C_PTHazard
Max. End Position learned	n.a.	2 times	Buzzer confirms learning finished
Max. End Position deleted	1 time	n.a.	Buzzer confirms "position deleted"
Car is moving with open T/gate	10 times	n.a.	T/gate open AND Speed >3km/h
Garage Position saved	2 times	n.a.	Buzzer confirms "New Garage Position"

*) Lamp will be synchronized by sending C_PTHazard simultaneously to Buzzer signal

- Inspection

Tailgate normal operation transmit / receive process

Information

- FOB key Switch : FOB key Switch → BMC / SMK → CAN communication → PTG Module
- Driver Switch : Driver Switch → Wiring → PTG Module
- Outer Switch : Outer Switch → Wiring → SJB → CAN communication → PTG Module

① Press the power tailgate open switch

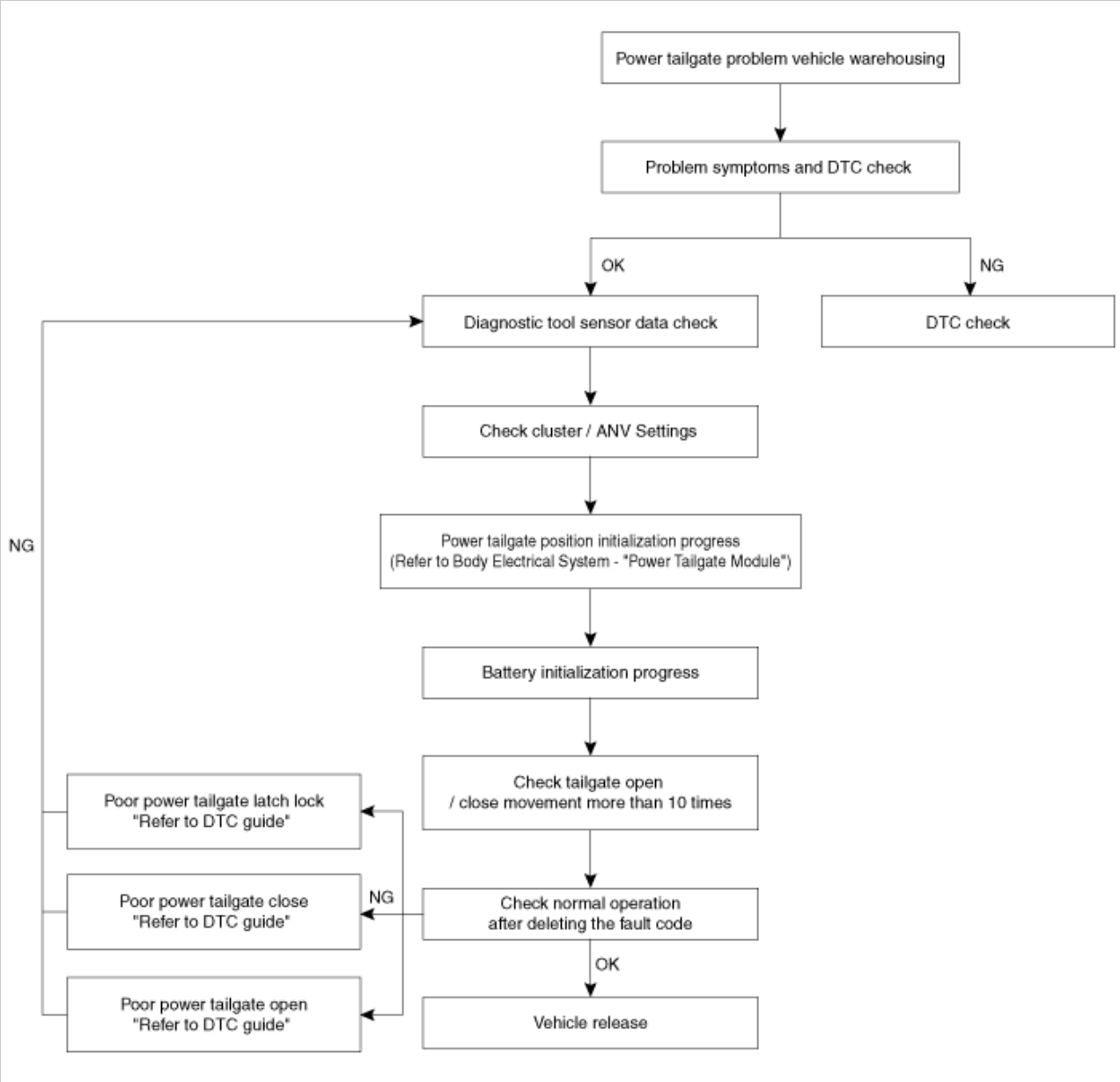
② Transmit / receive power tailgate open signal via CAN communication and wiring

③ Power tailgate open

Information

- The operation of the power tailgate is activated by mutual communication with the vehicle's module and switch.
- Before replacing parts, it is necessary to check the basic communication, switch signals, and contact points of wire connectors.

PTG Inspection Flow Chart



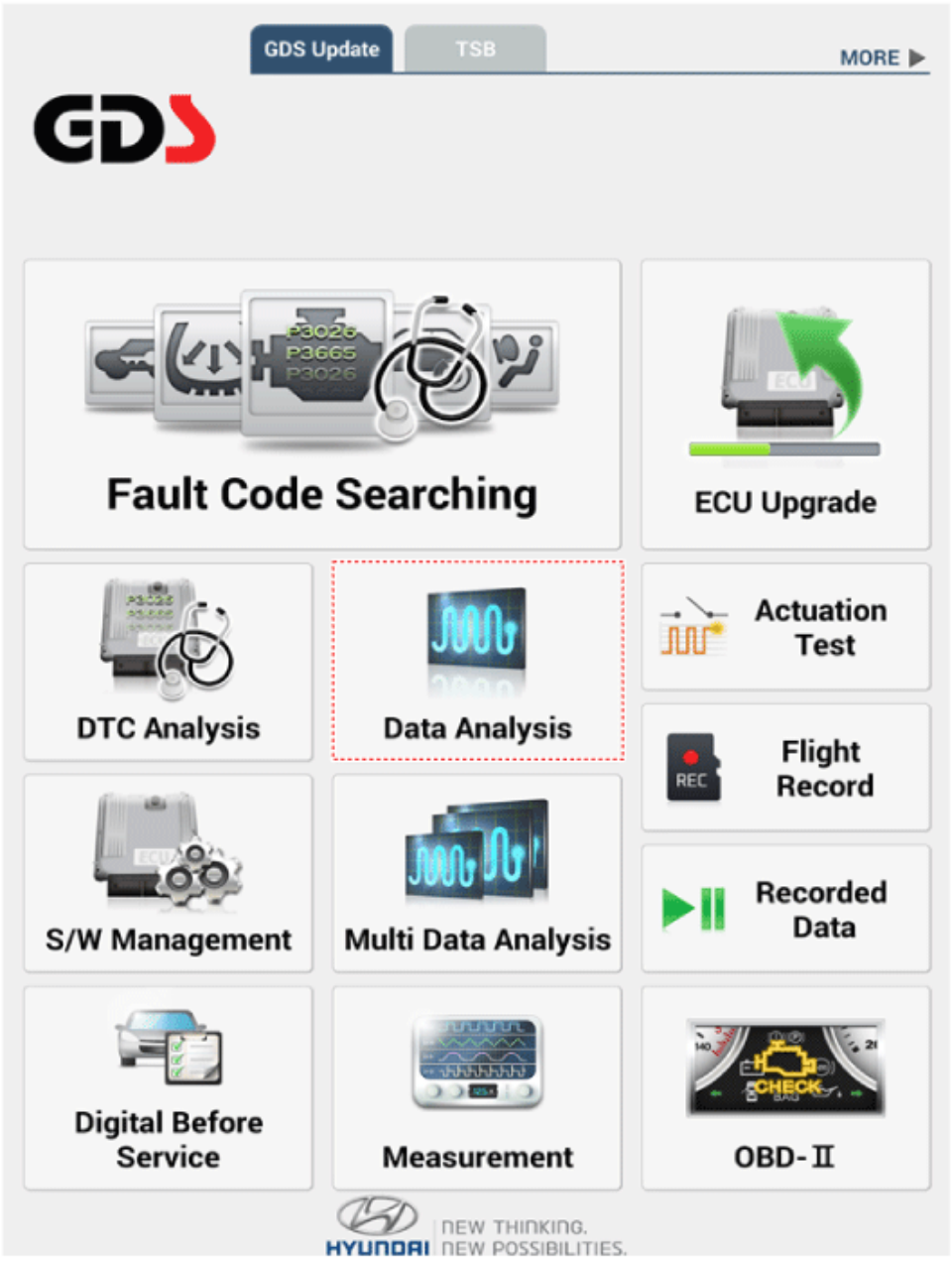
Power Tailgate NG List

List	Solution
CAN BUS OFF	Check CAN Line
Power Tailgate Module Inline Mode Not Deactivated	1. S/W Management - Disable Inline Mode
	2. Disable inline mode by driving (5 km/h↑)
PTG Unlatch Error	1. Check latch connector plugged in properly
	2. Check latch wiring
	3. Check latch assembly

PTG Spindle Hall Sensor Error, LH	1. Check spindle connector plugged in properly - LH
	2. Check spindle wiring - LH
	3. Check spindle assembly - LH
PTG Spindle Hall Sensor Error, RH	1. Check spindle connector plugged in properly - RH
	2. Check spindle wiring - RH
	3. Check spindle assembly - RH
PTG Anti-Pinch Sensor Error, LH	1. Check anti-pinch sensor connector plugged in properly - LH
	2. Check anti-pinch sensor wiring - LH
	3. Check anti-pinch sensor assembly - LH
PTG Anti-Pinch Sensor Error, RH	1. Check anti-pinch sensor connector plugged in properly - RH
	2. Check anti-pinch sensor wiring - RH
	3. Check anti-pinch sensor assembly - RH
PTG Latch Cinching Rewinding Fail Max	1. Check latch connector plugged in properly
	2. Check latch wiring
	3. Check latch assembly
PTG Integrated Latch Home Position Switch Error	1. Check latch connector plugged in properly
	2. Check latch wiring
	3. Check latch internal switch signal
	4. Check latch assembly
PTG Integrated Latch Switch Combination Error	1. Check latch connector plugged in properly
	2. Check latch wiring
	3. Check latch internal switch signal
	4. Check latch assembly

Sensor Data Diagnosis With Diagnostic Tool

1. Select the 'Data Analysis'.



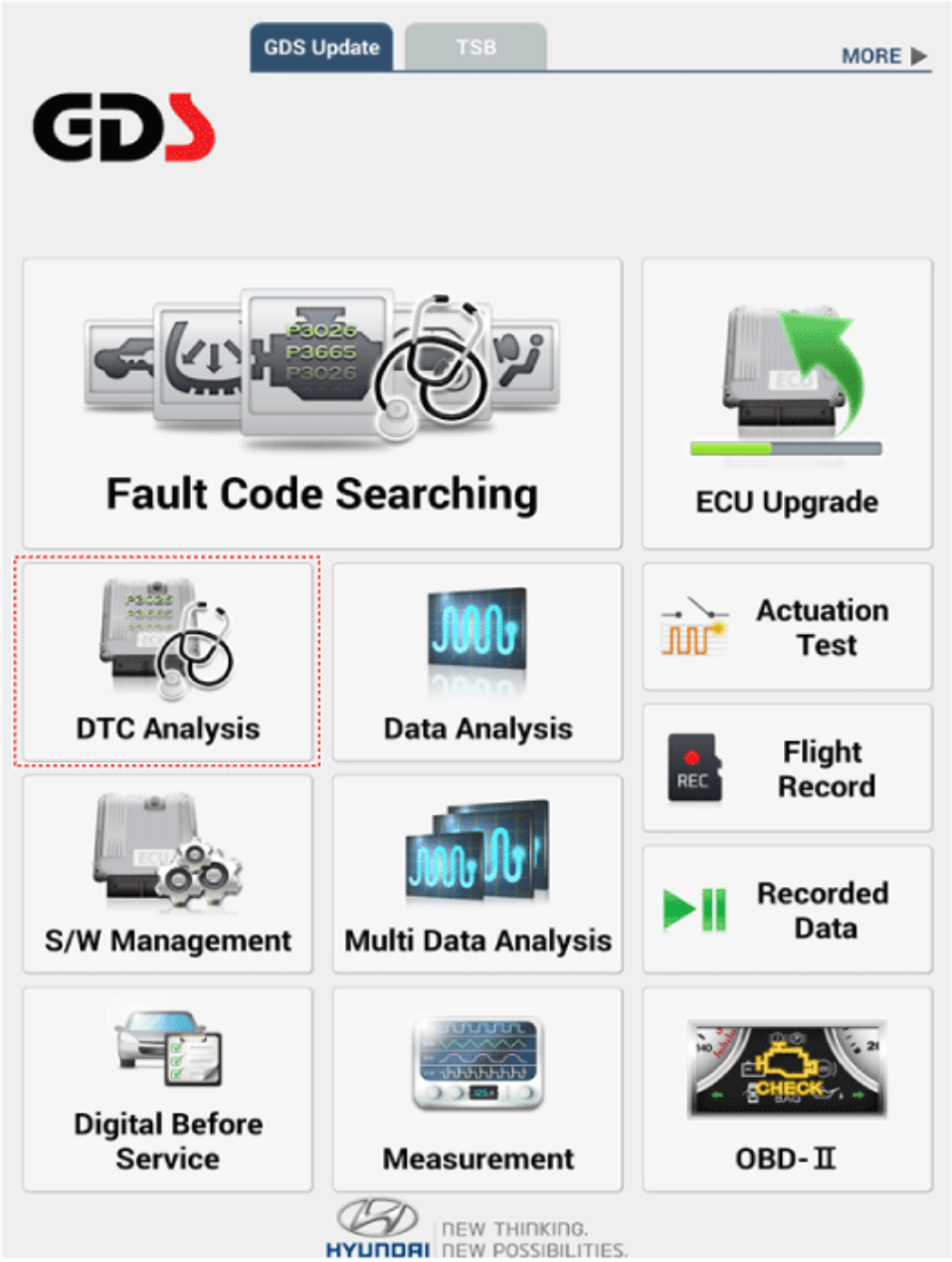
2. Select the 'PTG'.

3. Check the sensor data.

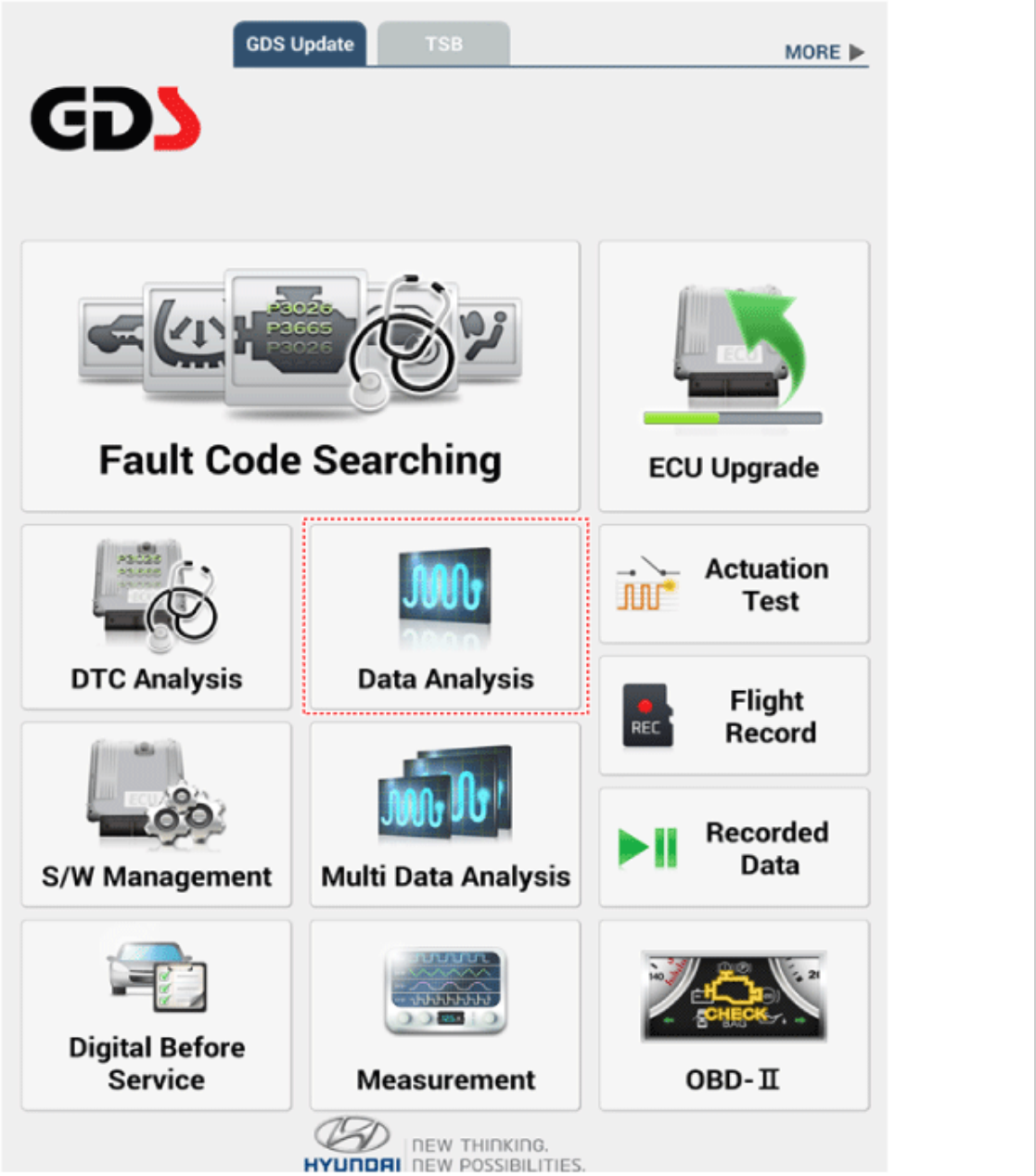
- Failure Inspection

Diagnosis with Diagnostic tool

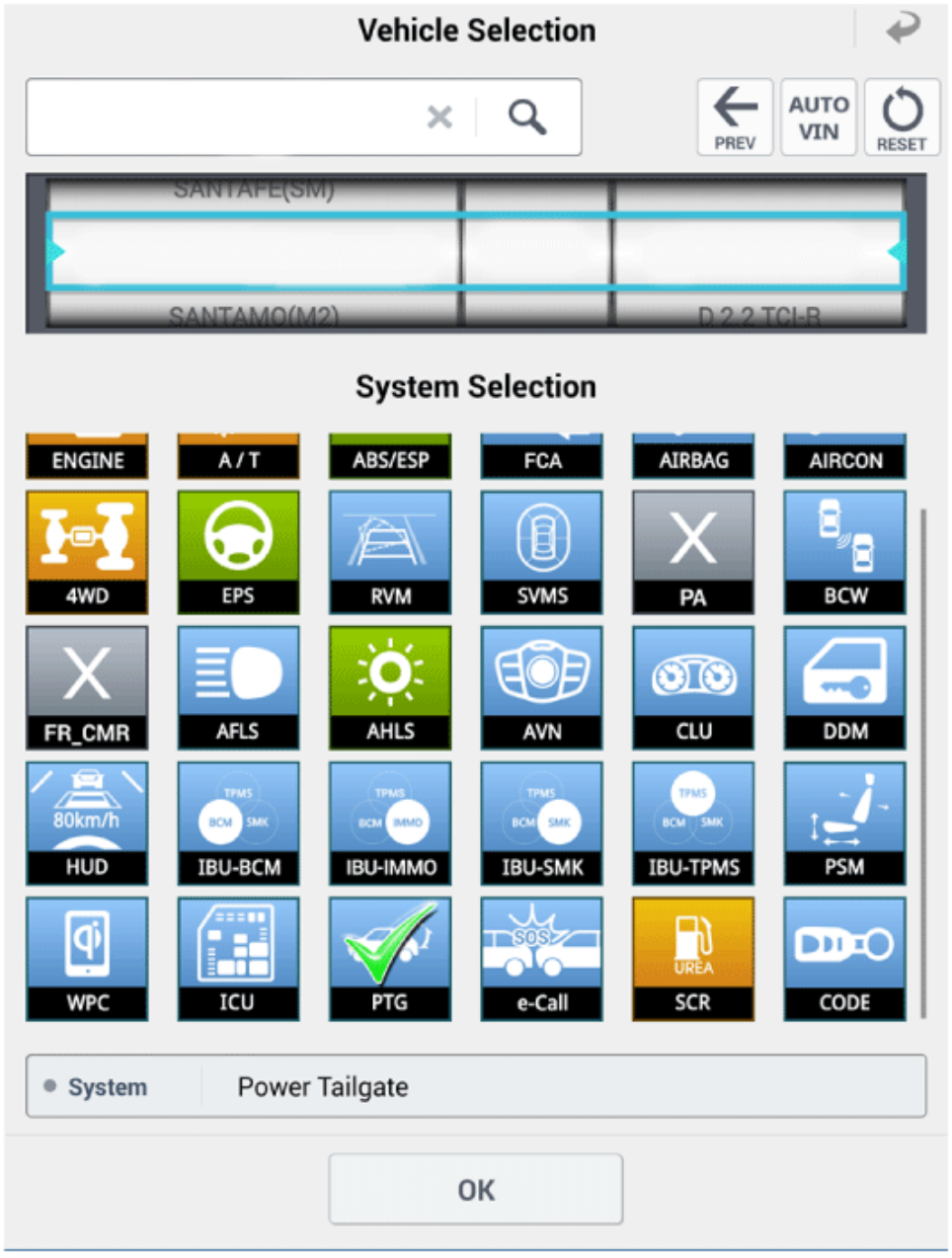
1. In the body electrical system, failure can be quickly diagnosed by using the vehicle diagnostic system (Diagnostic tool).
   The diagnostic system (Diagnostic tool) provides the following information.
   (1) Fault Code Searching : Checking failure and code number (DTC)
   (2) Data Analysis : Checking the system input/output data state
   (3) Actuation test : Checking the system operation condition
   (4) S/W Management : Controlling other features including system option setting and zero point adjustment
2. If diagnose the vehicle by Diagnostic tool, select "DTC Analysis" and "Vehicle".

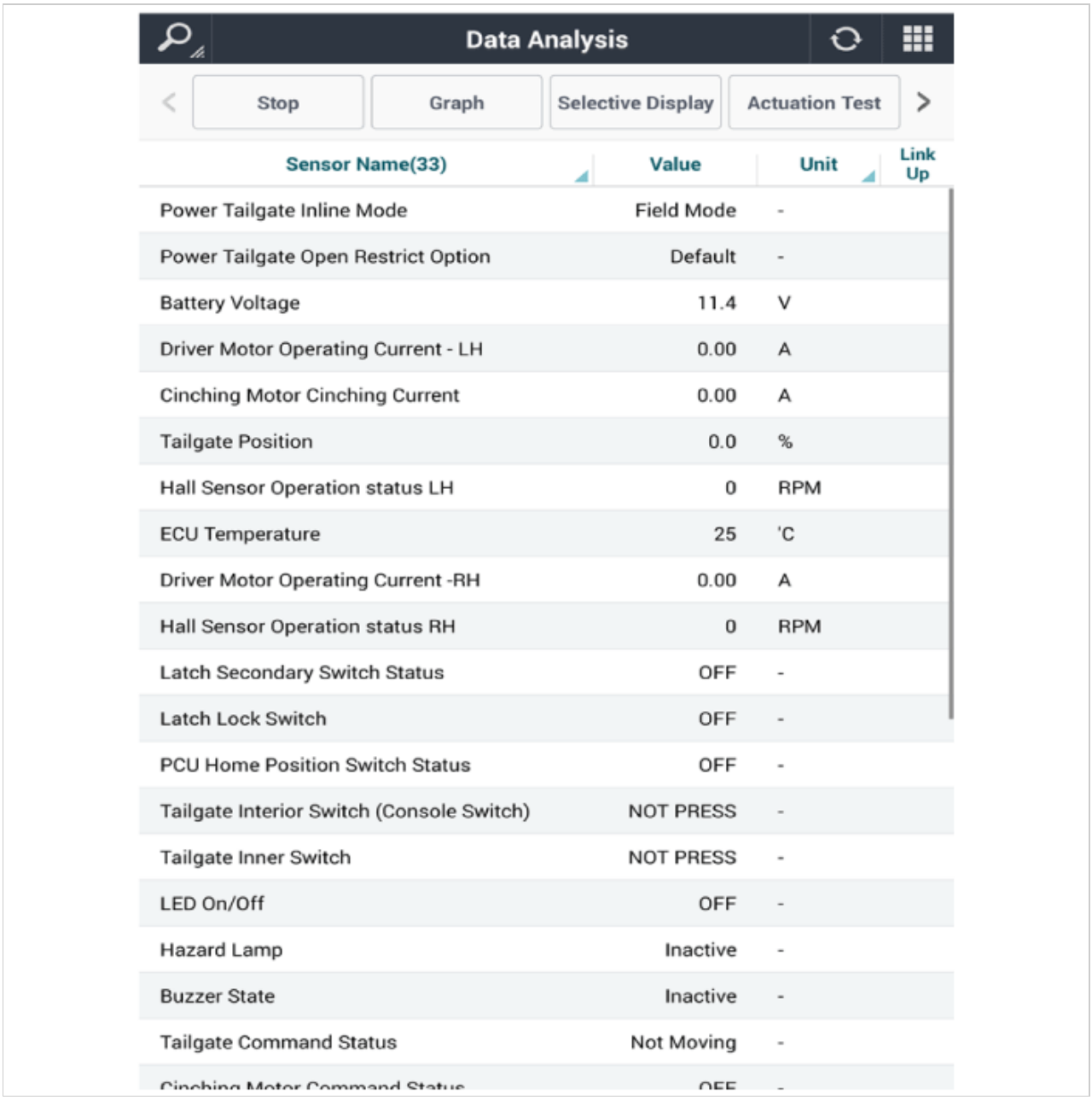


3. Select the 'Data Analysis'.



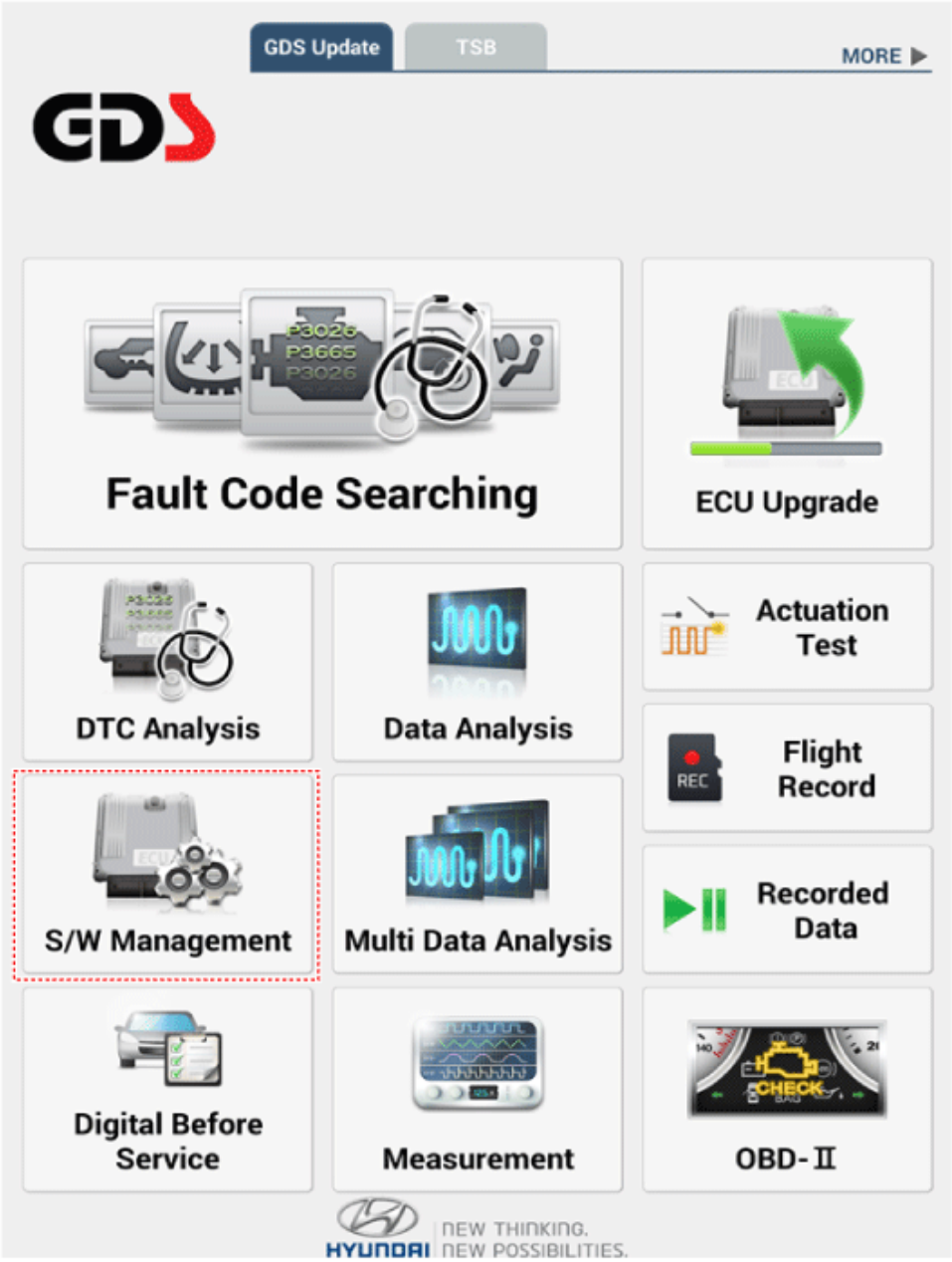
4. Select the 'PTG' to search the current state of the input/output data.


Vehicle Selection
PREV
AUTO VIN
RESET
SANTAFE(SM)
SANTAMO(M2)
D 2.2 TCI-R
System Selection
ENGINE
A / T
ABS/ESP
FCA
AIRBAG
AIRCON
4WD
EPS
RVM
SVMS
PA
BCW
FR_CMR
AFLS
AHLS
AVN
CLU
DDM
80km/h
HUD
IBU-BCM
IBU-IMMO
IBU-SMK
IBU-TPMS
PSM
WPC
ICU
PTG
e-Call
UREA
SCR
CODE
System
Power Tailgate
OK

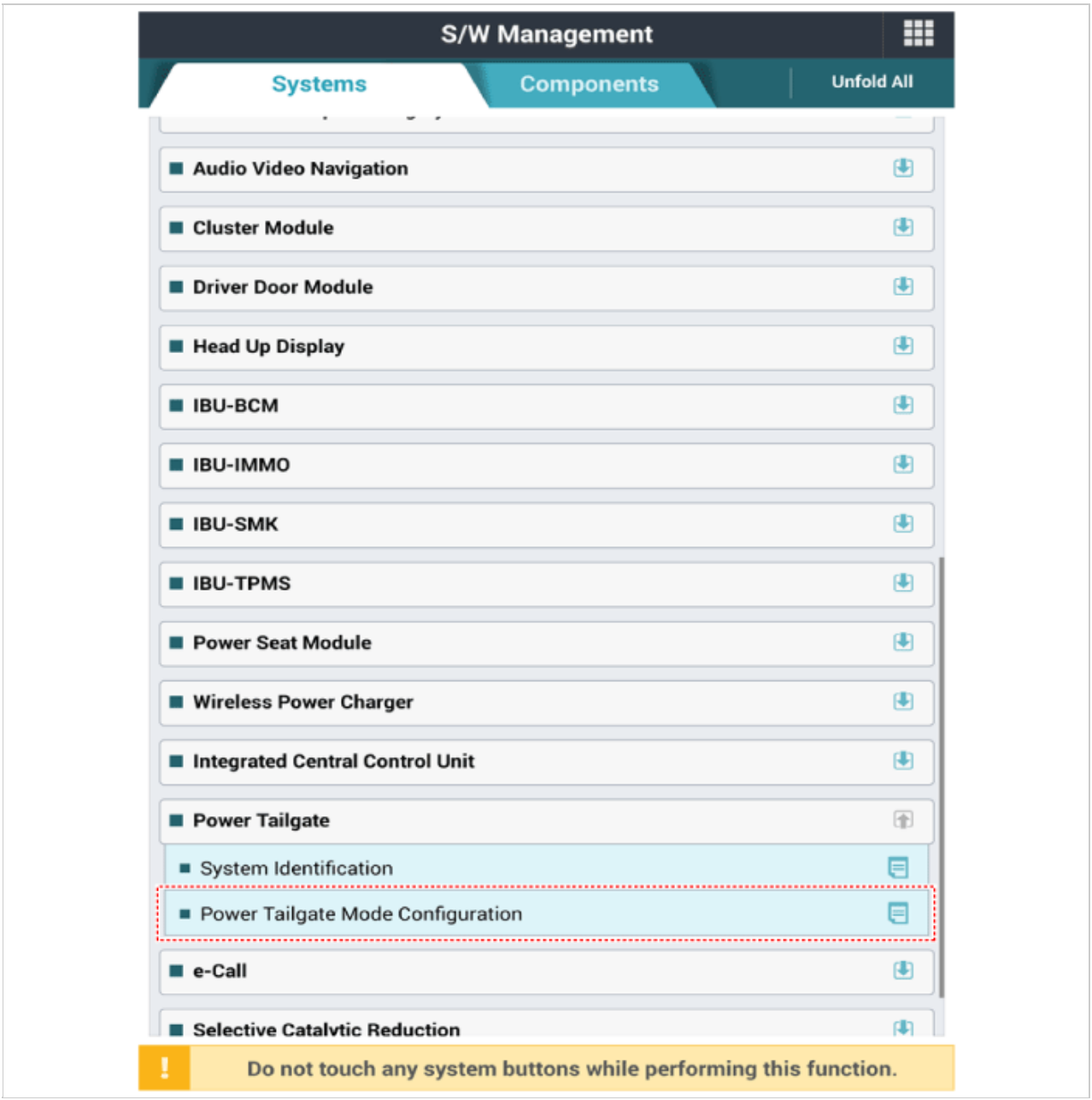


Mode Change (Power Tailgate System)

1. After replacing with a new power tailgate module, check for DTC code at all times.
   If DTC code B24B0 exists, perform power tailgate mode change.
2. After connecting the Diagnostic tool, Select the 'S/W Management' and 'Car model'.



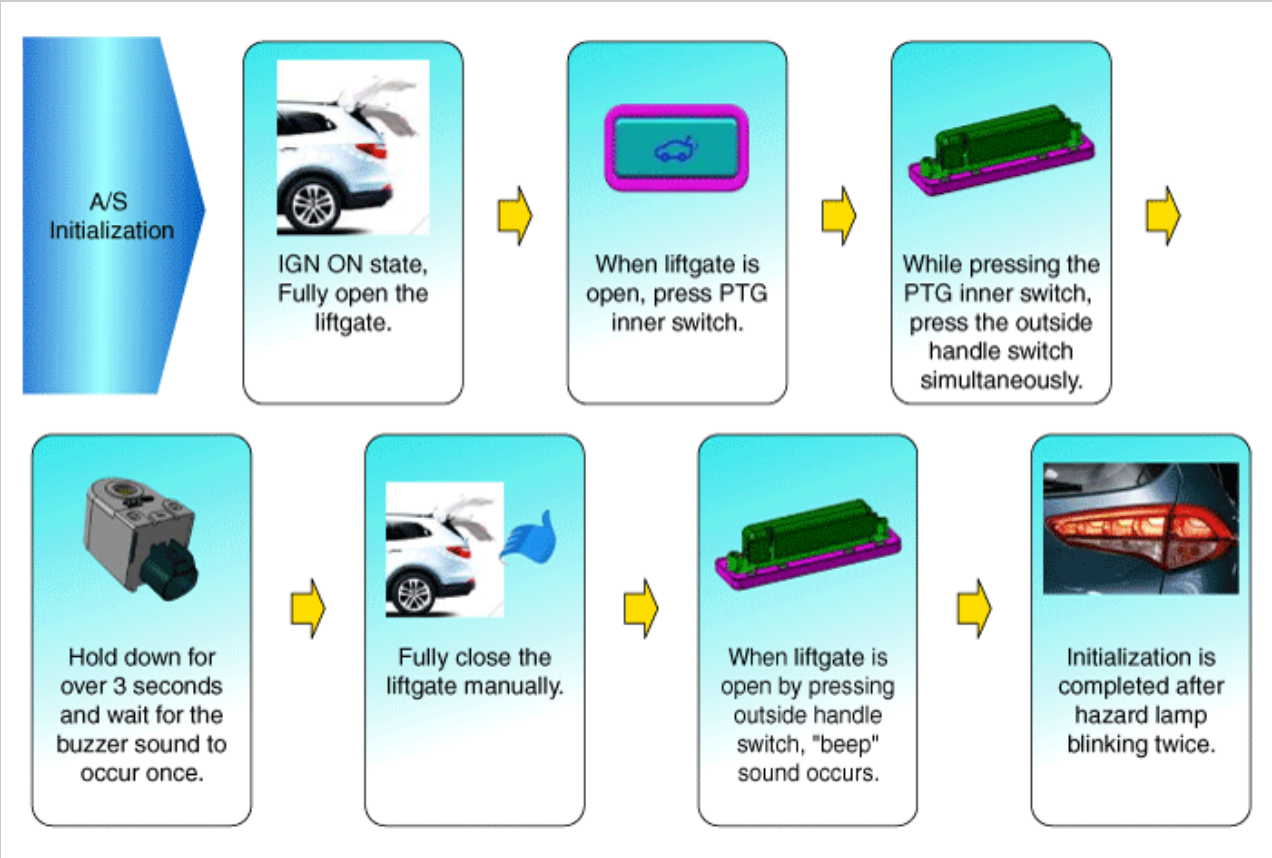
3. Select the "Power Tailgate" and Power Tailgate Mode Configuration" procedure.



4. Perform the "Power Tailgate Mode Configuration" procedure according to the Diagnostic tool screen message.

System Initialization

System initialization is needed to recognize the closing position of the tailgate to power tailgate module.
The initialization process after battery power reset, system initialization is needed to recognize the maximum opening and closing tailgate position exactly.
The power tailgate operates normally after system initialization is completed.
Procedure :


A/S Initialization
IGN ON state, Fully open the liftgate.
When liftgate is open, press PTG inner switch.
While pressing the PTG inner switch, press the outside handle switch simultaneously.
Hold down for over 3 seconds and wait for the buzzer sound to occur once.
Fully close the liftgate manually.
When liftgate is open by pressing outside handle switch, "beep" sound occurs.
Initialization is completed after hazard lamp blinking twice.

Inspection and Test - Power Tailgate System

Power Tailgate system is a complex system that consists of several components. To get an accurate test result, the control module of the Power Tailgate must be inspected.

The most trustworthy, effective and accurate method is using Diagnostic tool required by power tailgate.

Diagnostic tool helps technicians when inspecting a disabled switch, and enables to check the current status record of the switch ofPower Tailgate control module.

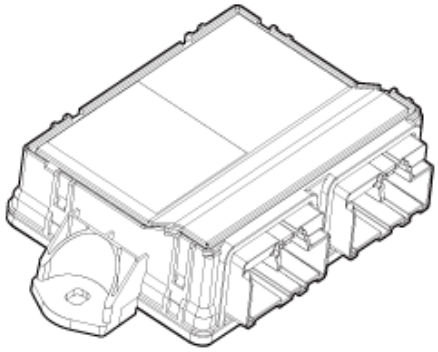
The battery must be fully charged before conducting all of the test on power tailgate, and all of the interfering elements of the system must be shown and understood. (refer to the explanation of smart tailgate) Refer to the analysis reference table when inspecting and testing the smart tailgate.

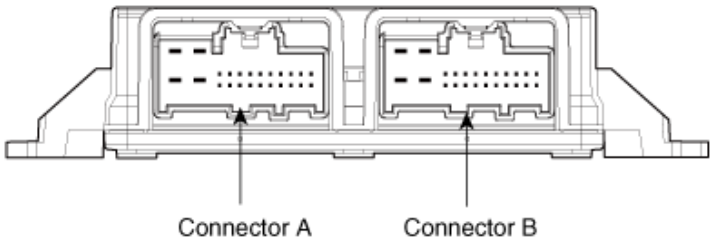
Status	Cause	Solution
Sudden opening of tailgate	Activation by mistake or malfunction of open/close switch	Check for short or malfunction of short circuit of switch
	Latch assembly failure	Check for wiring connection
		Check for failure code, and replace the latch if needed
	Failure of Smart Tailgate or the body control module	Reset the module fuse or reconnect the battery. If it does not operate properly, check the wiring connection and analyze manual.
Unable to power open and close the tailgate	False indication, or not parked status	Check a switch status using analyzing device
	Low voltage of the Power Tailgate module battery	Check for proper voltage of the Power Tailgate
		Battery charged
	Swelling of the fuse	Check if the fuse is swollen
	Malfunction of PTG spindle	Check for PTG spindle status
	Critical code failure at BCM/tailgate control module	Check for code status using Diagnostic tool
	Latch assembly failure	Check if the wiring connection of fuse are swollen.
		Check if there's any alien object interfering with the operation of latch assembly.
Unable to open and close of the tailegate	Failure in motor assembly	Check for motor assembly
	Interference of the consisting components	Replace the needed parts or reset the affected position.
	Wiring problem (system or vehicle)	Resolve the problem using the wiring map.
		Refer to wiring diagram.

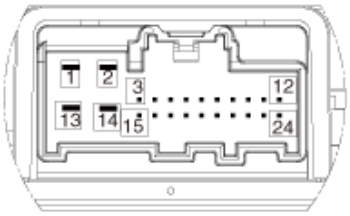
Loss of electricity during the tailgate operation	Wiring problem (system or vehicle)	Resolve the problem using the wiring map.
		Refer to wiring diagram.
	Low voltage of vehicle battery	Check for proper voltage of PTGM.
		Charge the battery
	Failure in Power Tailgate or BCM	Check for failure code using analyzing device
	Failure in motor assembly	Test the motor assembly
Power latching unable at Primary/Secondary position	Latch assembly failure	Check if the wiring connection of fuse are swollen.
		Check for failure code using analyzing device
		Resolve the problem using a vehicle analyzing manual.
		Replace the latch assembly if needed.
	Interference of the consisting components	Replace the needed parts or reset the affected position.
	Failure in Power Tailgate or BCM	Check for failure code using analyzing device
	Excessive sealing force of the tailgate	Check for shock on sealing, assembly failure, alien object or other possible factors.
	Failure in motor assembly	Check the motor assembly
Unable to unlock the latch at Primary position	False indication, or not parked status	Check switch status using analyzing device
	Low voltage of the Power Tailgate module battery	Check for proper voltage of the Power Tailgate
		Battery charged
	Swelling of the fuse	Check if the fuse is swollen
	Latch assembly failure	Check switch status using analyzing device
		Check for alien object interfering with the latch assembly operation or shock on components.
		Resolve the problem using a vehicle analyzing manual.
		Remove the latch assembly if needed.
	Failure in outside handle connection	Check for handle joint and wiring connection.
	Failure of Power Tailgate or the body control module	Check for the failure code or cycle using analyzing device.
	Interference of the consisting components	Replace the needed parts or reset the affected position.
Tailgate operation using pop/console switch unavailable.	Swelling of the fuse	Check if the fuse is swollen
	Low voltage of PTGM	Check for proper voltage of PTGM.
		Charge the battery
Unable to unlock the electric lock	Failure on the latch assembly	Check for alien object interfering with the latch assembly operation or shock on components.
		Check for the failure code or cycle using analyzing device.
		Check for pole/latch switch using analyzing device.
		Resolve the problem using the vehicle inspection manual
Unable to unlock the electric lock	Failure of Power Tailgate module	Resolve the problem using the vehicle inspection manual
	Failure of Body Control Module (BCM)	Resolve the problem using the vehicle inspection manual
		Replace BCM if needed
	Malfunctioning of wireless remote control key	Rewrite the wireless remote control key program
		Replace the wireless remote control key
	Malfunctioning of the tailgate motor assembly	Check for alien object interfering with the motor assembly operation.
		Check for wiring connection
		Change the assembly if motor clutch is not operable
		Replace the switch if the full opening switch is not working
		Resolve the problem using the vehicle inspection manual
		Replace the motor if needed
Unable to maintain opened status of the tailgate	Failure on PTG spindle	Replace PTG spindle
		Check if attached objects are damaged
Excessive operating force when opening and closing	Failure on PTG spindle	Replace PTG spindle
		Check if attached objects are damaged
	Interference of the consisting components	Replace the needed parts or reset the affected position.
When tailgate keeps cinching lock mode	Failure on the latch assembly	Check if wiring connection and fuse are swollen
		Check the switch with analyzing device
	Failure on the latch assembly	Check for wiring connection

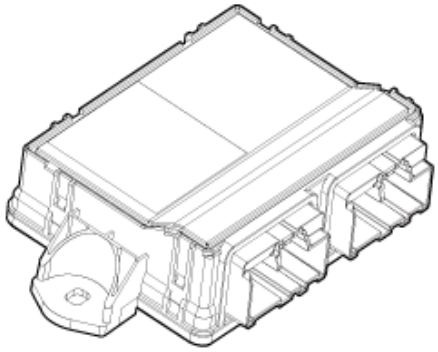
When tailgate keeps electric lock mode	Failure on the latch assembly	Check for any alien object
		Resolve the problem using the vehicle inspection manual
	Malfunctioning of the control module	Check for failure code using analyzing device
	Wiring problem (system or vehicle)	Resolve the problem, referring an electric circuit
		Refer to wiring diagram.
		Check for the vehicle inspection manual for detailed process
	Failure of the motor assembly	Check for operating environments constantly
	Wiring problem (system or vehicle)	Resolve the problem, referring an electric circuit
		Refer to wiring diagram.
Very slow opening of the tailgate	Vehicle battery voltage too low	Check for proper voltage of PTGM.
		Charge the battery
	Malfunctioning of the tailgate PTG spindle	Replace the tailgate PTG spindle if needed
	Interference of the consisting components	Replace the needed parts or reset the affected position.
	Vehicle angle too steep for electric operation	Operate the tailgate manually
	Malfunctioning of the tailgate motor assembly	Replace the motor assembly if needed
Rattling or squeaky sound	Alien object jammed in tailgate components	Remove the alien object
	Excessive tightening or loosening of the components	Resolve the excessive tightness or looseness

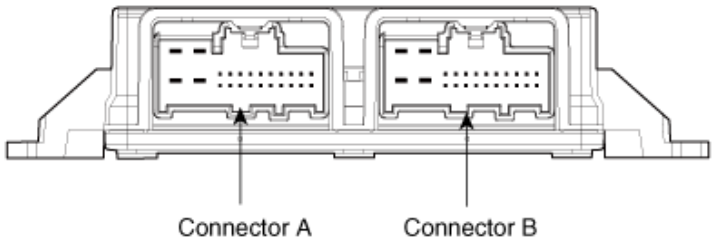
- Components

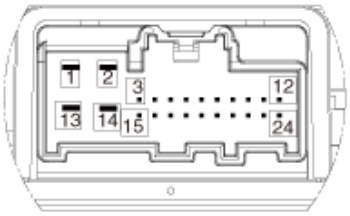




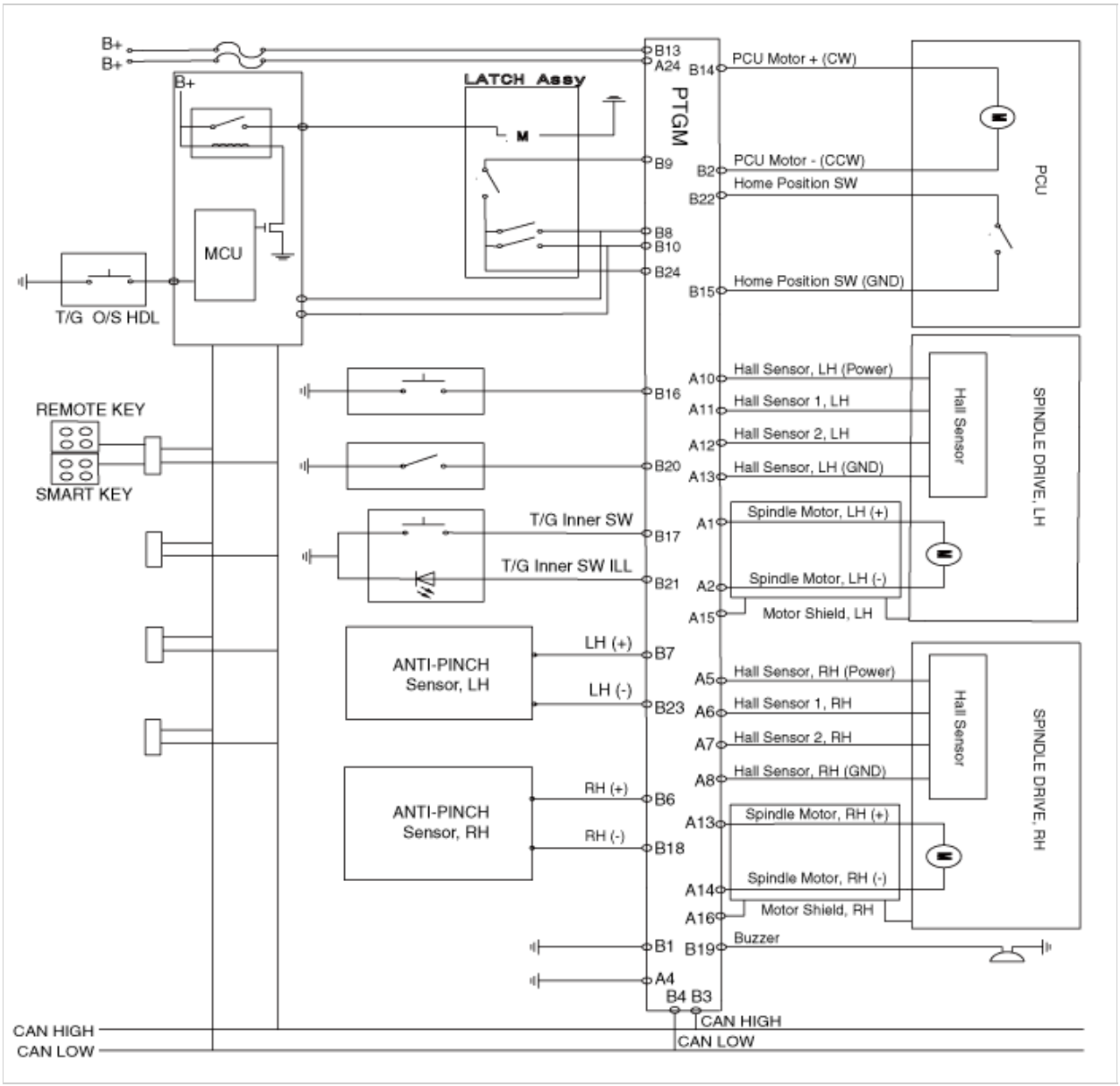
Connector A			
			
No	Description	No	Description
1	Spindle motor left (+)	13	Spindle motor right (+)
2	Spindle motor left (-)	14	Spindle motor right (-)
3	-	15	Spindle sheld 1
4	GND2	16	Spindle sheld 2
5	Hall sensor right power	17	-
6	Hall sensor right 1	18	-
7	Hall sensor right 2	19	-
8	Hall sensor right GND	20	-
9	-	21	-
10	Hall sensor left 1	22	-
11	Hall sensor left 1	23	Hall sensor left GND
12	Hall sensor left 2	24	Battery (+)





Connector B			
			
No	Description	No	Description
1	GND 1	13	Motor power
2	PCU motor (-)	14	PCU motor (+)
3	HS - CAN (High)	15	GND (PCU home switch)
4	HS - CAN (Low)	16	Tail gate switch (lower crashpad)
5	-	17	Tail gate inner switch
6	Anti-pinch strip RH (+)	18	Antipinch strip RH (-)
7	Anti-pinch strip LH (+)	19	Buzzer
8	Latch Full open Switch	20	Tail gate inner switch ILL
9	Latch Half lock Switch	21	Neutral switch (M/T)
10	Latch Full lock Switch	22	PCU home position switch
11	-	23	Antipinch strip LH (-)
12	-	24	Latch switch GDN

- Circuit Diagram



Body Electrical System

- Removal

⚠ CAUTION

1) After replacing with a new power tailgate module, check for DTC code at all times.
   If DTC code B24B0 exists, perform power tailgate mode change.
   (Refer to Power Tailgate Module - "Troubleshooting")
2) After replacing with a new power tailgate module, perform the system initialization.
   (Refer to Power Tailgate Module - "Troubleshooting")
3) Before delivery to customer, operate the power tailgate to be sure that there is no warning sound.

1. Disconnect the negative (-) battery terminal.
2. Remove the rear left luggage side trim.
   (Refer to Body - "Luggage Side Trim")
3. Remove the power tailgate unit connectors (A).

4. Remove the power tailgate unit (A).

- Installation

1. Install the power tailgate unit.
2. Install the rear left luggage side trim.
3. Connect the negative (-) battery terminal.

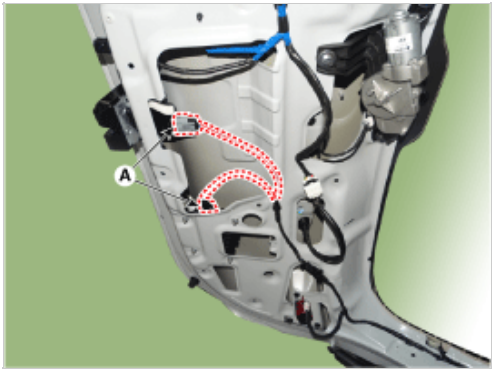
- Inspection

Inspection of the Power Tailgate System

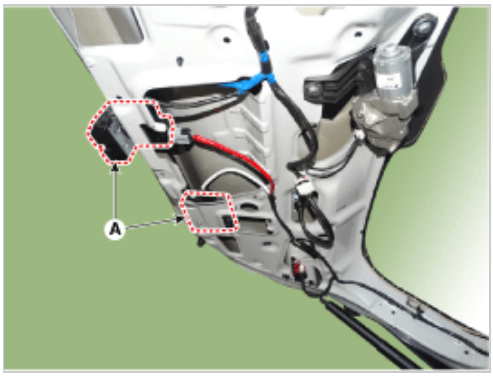
Refer to Power Tailgate System - "Troubleshooting"

- Removal

1. Disconnect the negative (-) battery terminal.
2. Remove the tailgate trim.
   (Refer to Body - "Tailgate Trim")
3. Disconnect the power tailgate latch and PCU connector (A).



4. Remove the power tailgate latch and PCU (A) assembly after loosening moungting nuts & bolts.



- Installation

1. Install the power tailgate latch & PCU assembly.
2. Install the tailgate trim.
3. Connect the negative (-) battery terminal.

- Inspection

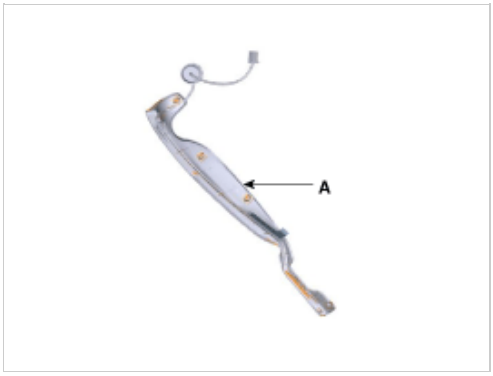
Inspection of the Power Tailgate Latch

Refer to Power Tailgate System - "Troubleshooting"

- Removal

1. Disconnect the negative (-) battery terminal.
2. Remove the tailgate trim.
   (Refer to Body - "Tailgate Trim")
3. Remove the anti-pinch strip sensor connector (A).

4. Remove the anti-pinch strip (A) after removing the clips.

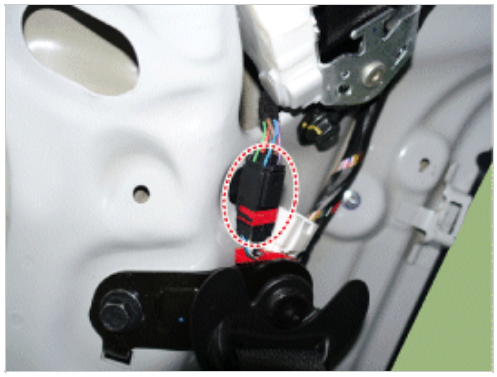


- Installation

1. Install the tailgate anti-pinch strip.
2. Install the tailgate trim.
3. Connect the negative (-) battery terminal.

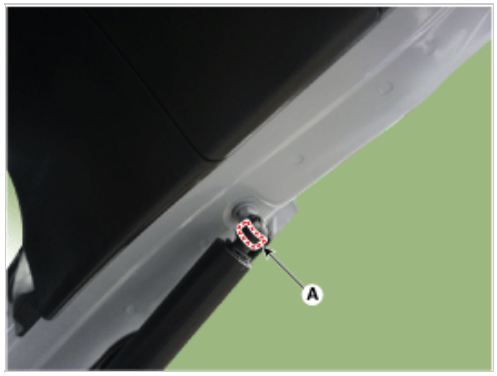
- Removal

1. Disconnect the negative (-) battery terminal.
2. Remove the luggage side trim.
   (Refer to Body - "Luggage Side Trim")
3. Disconnect the power PTG spindle connector (A).



4. Using a screwdriver , lift up slightly the socket clips (A).

> **⚠ CAUTION**
> Take care not to be closed the tail gate, when removing the lift.



5. If it is necessary, remove the nuts and replace the PTG spindle bracket (A).

- Installation

1. Connect the PTG spindle connector and then install the PTG spindle.

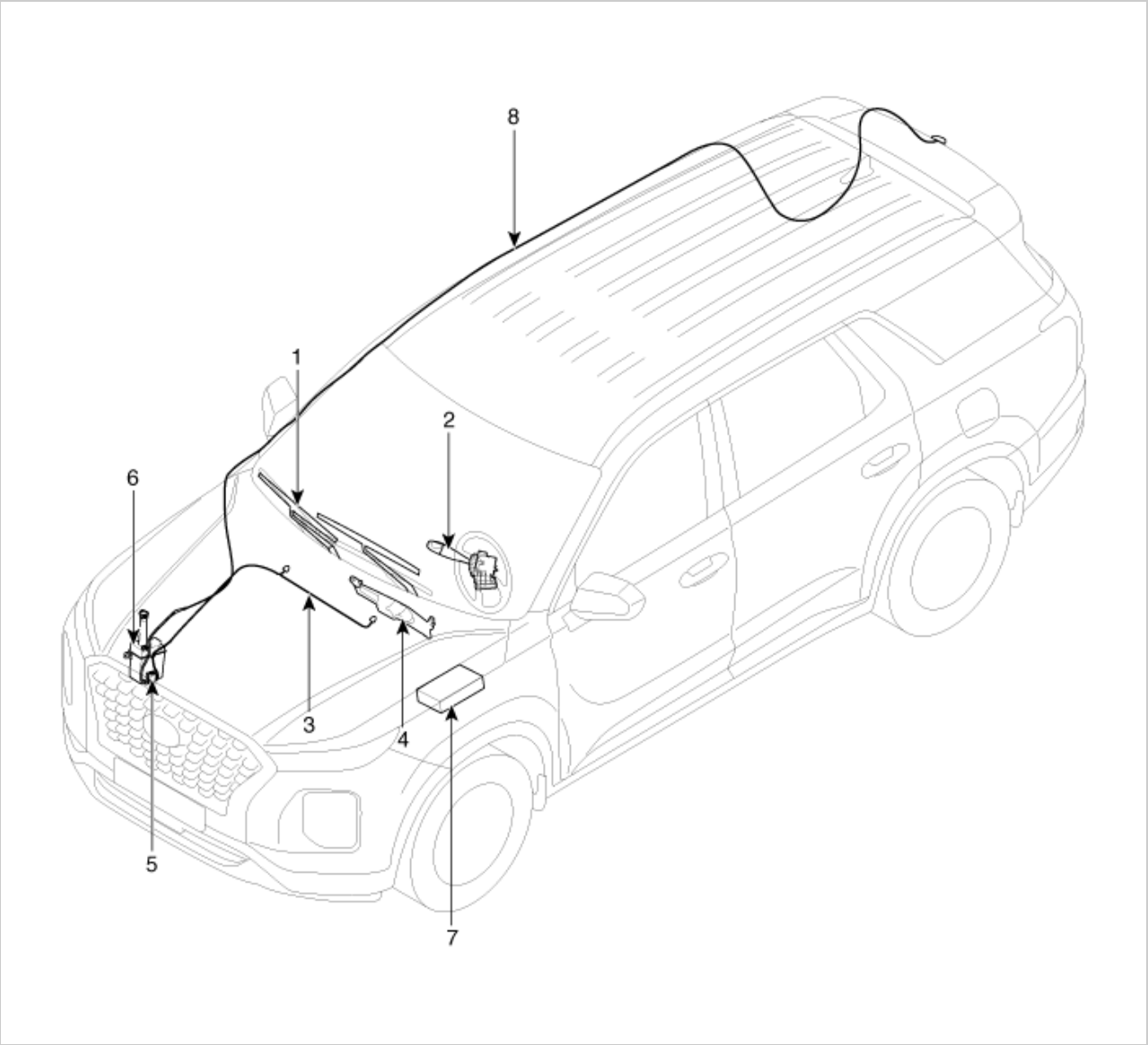
Tightening torque :

6.9 - 10.8 N.m (0.7 - 1.1 kgf.m, 5.1 - 8.0 lb-ft)

2. Install the tailgate trim and Luggage side trim.
3. Connect the negative (-) battery terminal.

Body Electrical System

- Component Location



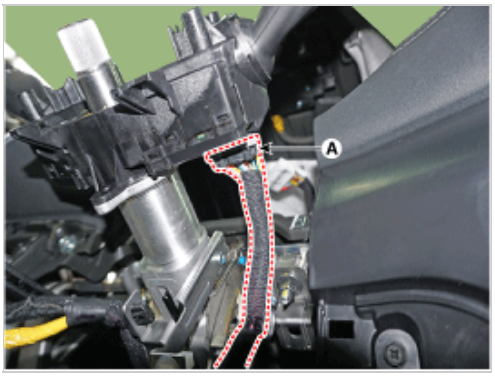
1. Windshield wiper arm & blade
2. Wiper & washer switch
3. Windshield washer hose
4. Windshield wiper motor & linkage
5. Washer motor
6. Washer reservoir
7. Front wiper relay
8. Rear washer hose & nozzle

Body Electrical System

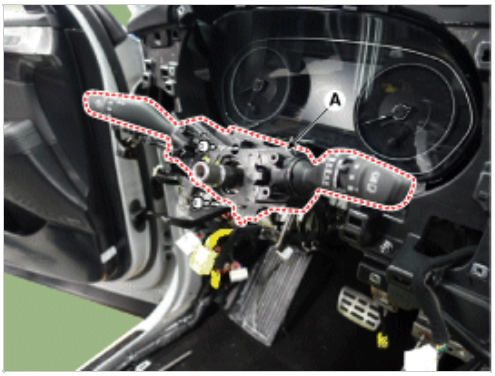
- Removal

1. Disconnect the negative (-) battery terminal.
2. Remove the steering wheel.
   (Refer to Steering System - "Steering Wheel")
3. Remove the steering columm shround.
   (Refer to Steering System - "Steering Columm Shround panel")

4. Remove the clock spring.
   (Refer to Restraint - "Driver Airbag(DAB) and Clock Spring")
5. Remove the multifunction connector (A).



6. Remove the multifunction switch (A) after loosening the mounting screws (2EA).

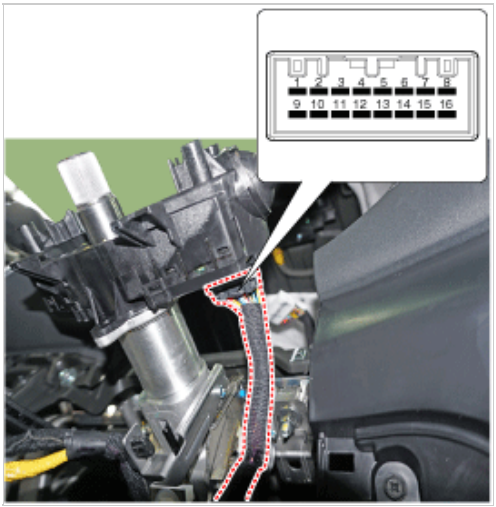


- Installation

1. Install the multifunction switch after connecting the connector.
2. Install the clock spring and steering.
3. Install the upper and lower shroud.
4. Install the steering wheel.

- Inspection

1. Check for continuity between the terminals in each switch position as shown below.

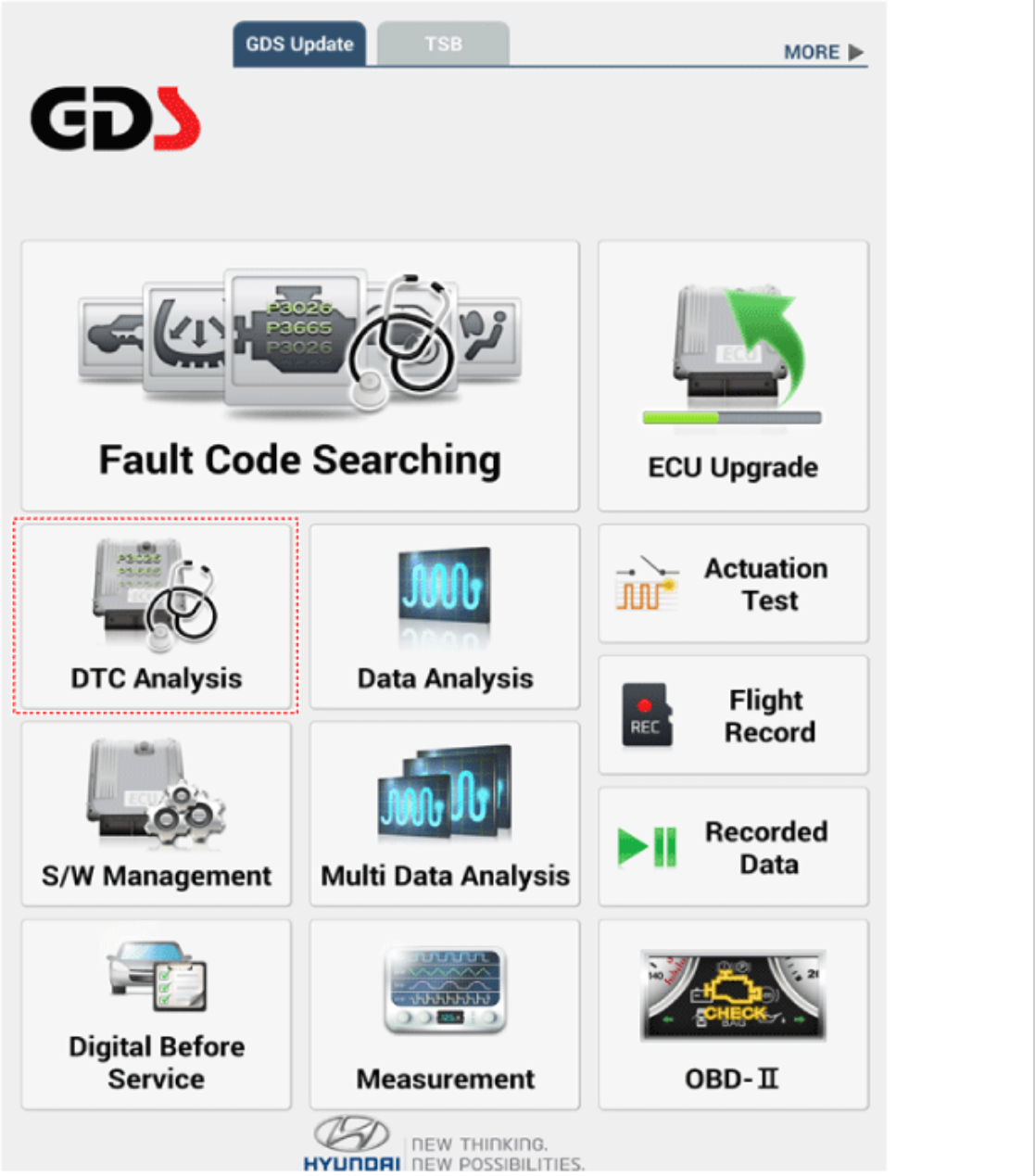


Switch	Switch position	Switch terminal	Resistance (Ω, ±3.5%)
Front wiper switch	MIST	1-9	330
	OFF		∞

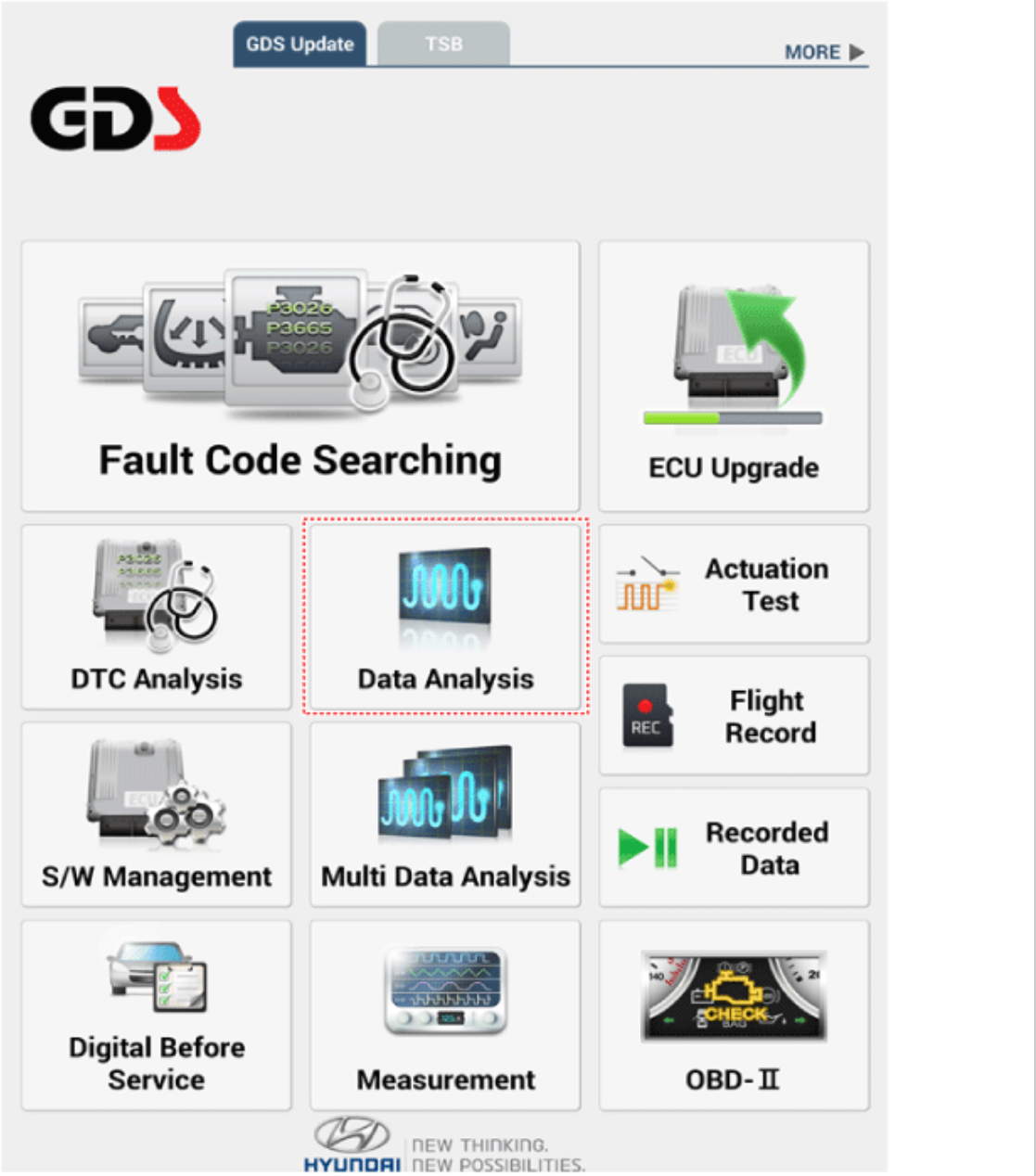
Front wiper switch	INT (AUTO)	1-9	800
	LOW		1800
	HIGH		5700
Front wiper intermittent volume	Volume 1	7-9	330
	Volume 2		690
	Volume 3		1310
	Volume 4		2610
	Volume 5		7310
Rear wiper switch	OFF	4-16	∞
	LOW		910
	HIGH		2000
Fog lamp switch	OFF	9-10	∞
	Front foglamp		910
	Rear foglamp		2910
Turn signal switch	OFF	9-12	∞
	Left		910
	Right		2910
Dimmer & Passing switch	OFF	9-13	∞
	Passing		910
	Dimmer		2910
Light switgh	OFF	9-14	680
	AUTO / DRL		∞
	Tail lamp		1680
	Low beam		5580

Inspection (With Diagnostic tool)

1. In the body electrical system, failure can be quickly diagnosed by using the vehicle diagnostic system (Diagnostic tool).
   The diagnostic system (Diagnostic tool) provides the following information.
   (1) Fault Code Searching : Checking failure and code number (DTC)
   (2) Data Analysis : Checking the system input/output data state
   (3) Actuation test : Checking the system operation condition
   (4) S/W Management : Controlling other features including system option setting and zero point adjustment
2. If diagnose the vehicle by Diagnostic tool, select "DTC Analysis" and "Vehicle".

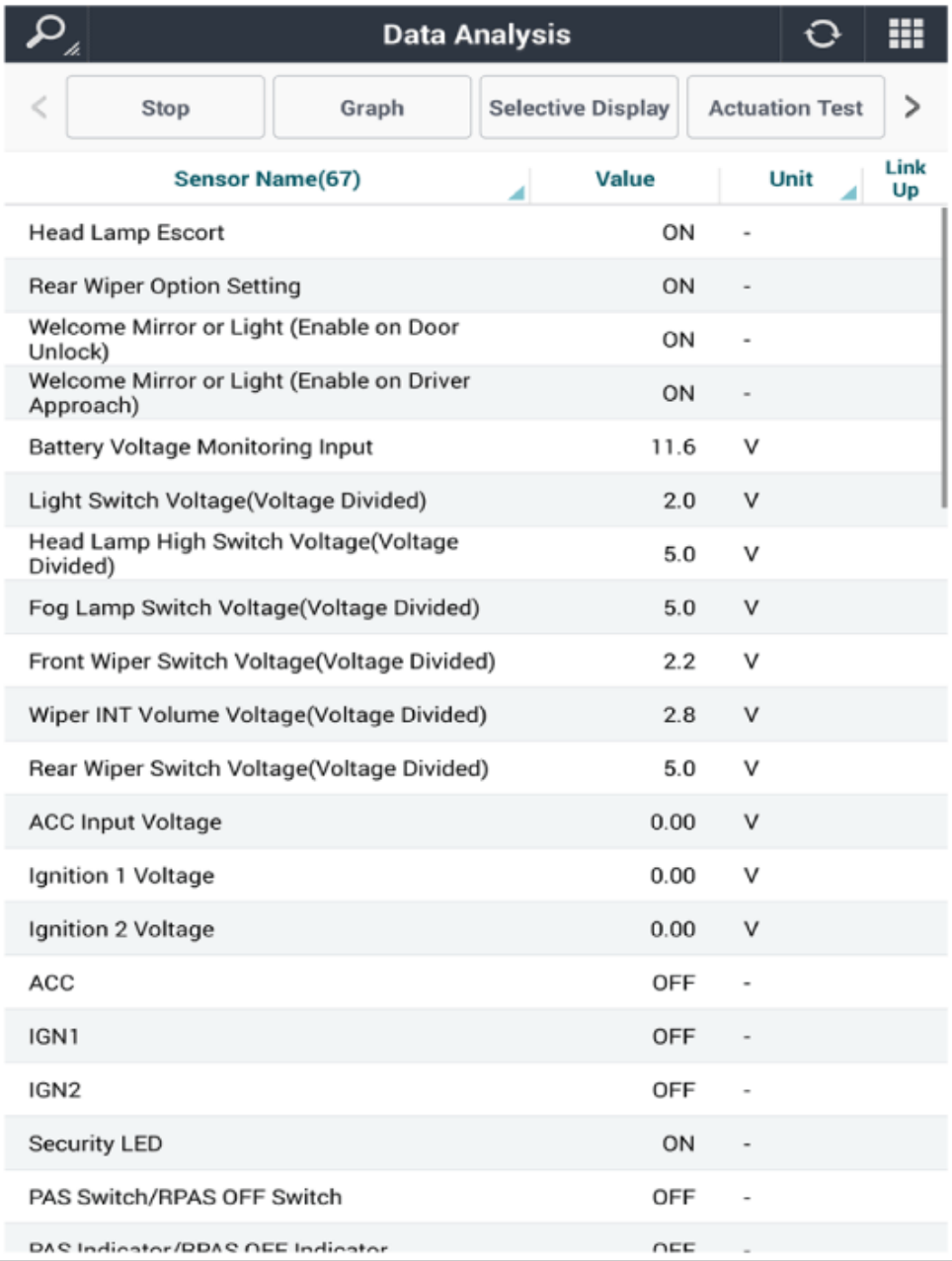


3. If check current status, select the "Data Analysis" .



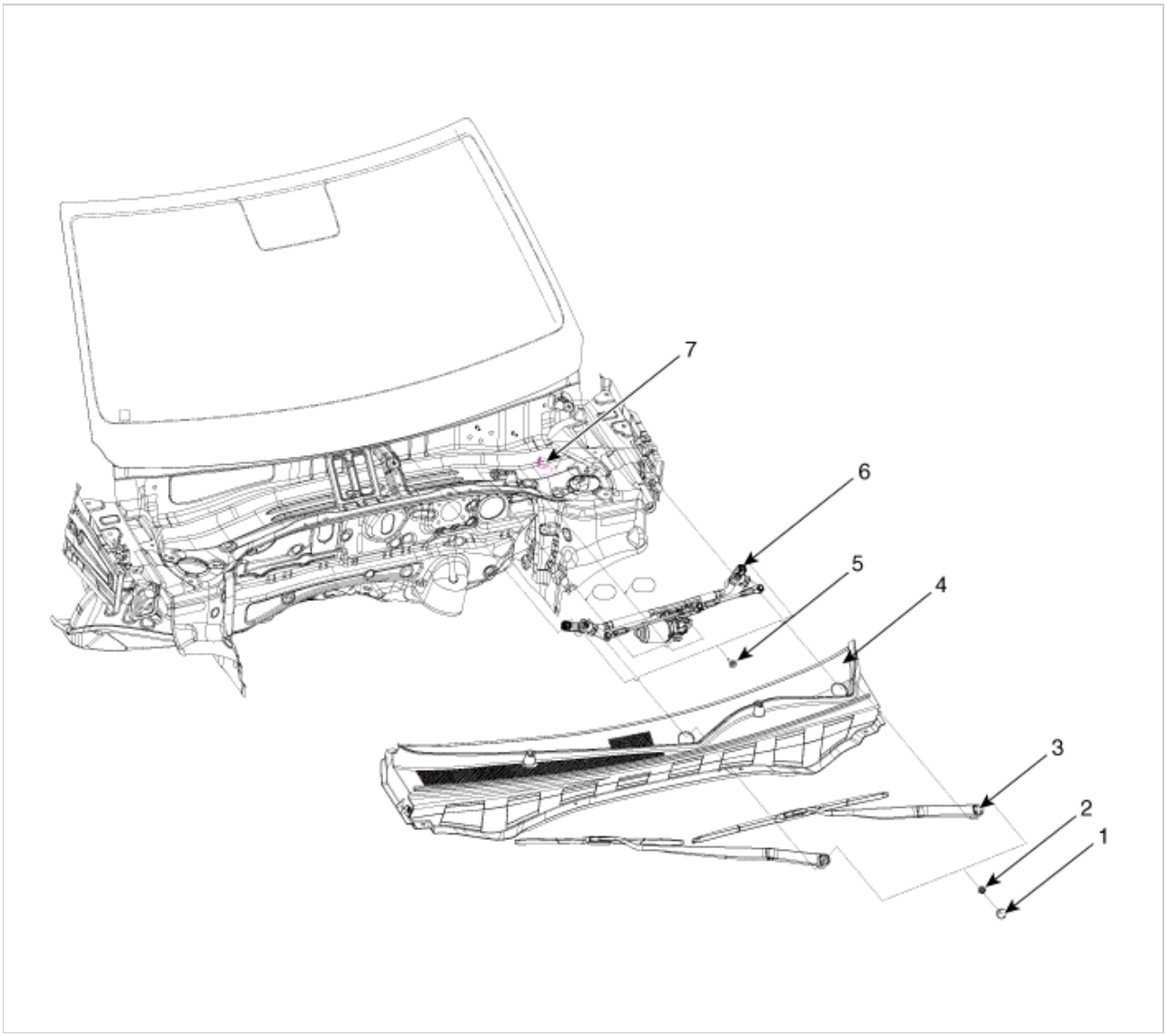
4. Select the 'IBU_BCM' to search the current state of the input/output data.

Vehicle Selection
PREV
AUTO VIN
RESET
SANTAFE(SM)
SANTAMO(M2)
D 2.2 TCI-R
System Selection
ENGINE
A / T
ABS/ESP
FCA
AIRBAG
AIRCON
4WD
EPS
RVM
SVMS
PA
BCW
FR_CMR
AFLS
AHLS
AVN
CLU
DDM
80km/h
HUD
IBU-BCM
IBU-IMMO
IBU-SMK
IBU-TPMS
PSM
System
IBU-BCM
OK



Sensor Name(67)	Value	Unit	Link Up
Head Lamp Escort	ON	-	
Rear Wiper Option Setting	ON	-	
Welcome Mirror or Light (Enable on Door Unlock)	ON	-	
Welcome Mirror or Light (Enable on Driver Approach)	ON	-	
Battery Voltage Monitoring Input	11.6	V	
Light Switch Voltage(Voltage Divided)	2.0	V	
Head Lamp High Switch Voltage(Voltage Divided)	5.0	V	
Fog Lamp Switch Voltage(Voltage Divided)	5.0	V	
Front Wiper Switch Voltage(Voltage Divided)	2.2	V	
Wiper INT Volume Voltage(Voltage Divided)	2.8	V	
Rear Wiper Switch Voltage(Voltage Divided)	5.0	V	
ACC Input Voltage	0.00	V	
Ignition 1 Voltage	0.00	V	
Ignition 2 Voltage	0.00	V	
ACC	OFF	-	
IGN1	OFF	-	
IGN2	OFF	-	
Security LED	ON	-	
PAS Switch/RPAS OFF Switch	OFF	-	
PAS Indicator/RPAS OFF Indicator	OFF	-	

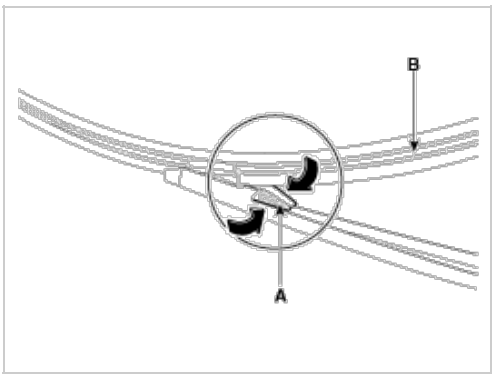
- Component Location



1. Cap
2. Nut
3. Wiper arm & blade
4. Cowl top cover
5. Bolt
6. Wiper motor & linkage assembly
7. Wiper motor connector

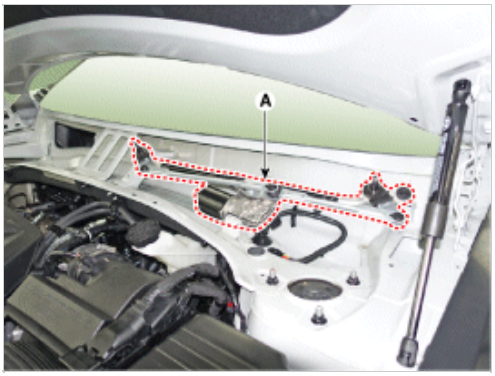
- Removal

1. Disconnect the negative (-) battery terminal.
2. If necessary, release the wiper blade fixing clip(A) by pulling up and remove the wiper blade(B) from the inside radius of wiper arm.

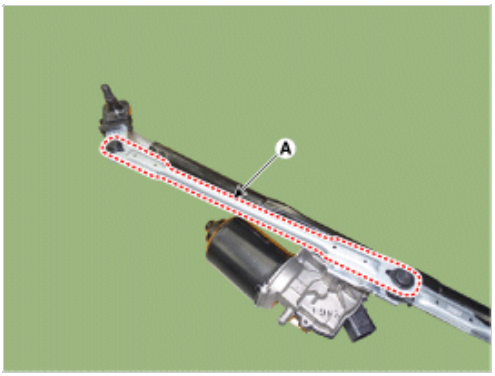


3. Remove the cowl top cover.
   (Refer to Body - "Cowl Top Cover")
4. Disconnect the wiper motor connector (A) from the wiper motor & linkage assembly.

5. Remove the windshield wiper motor and linkage assembly (A) after removing 2 bolts.



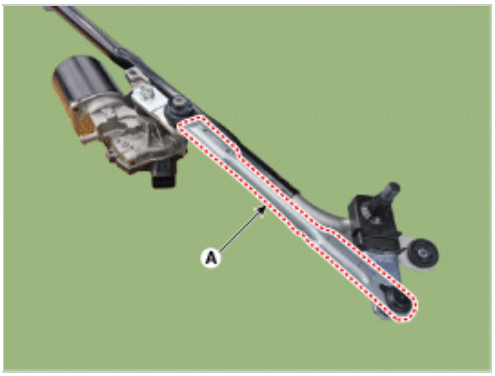
6. Hold the wiper motor crank arm and remove the upper linkage (A) from the wiper motor crank arm.



⚠ CAUTION

Before removing the wiper motor and linkage assembly, make sure that the linkage is stoped at auto stop position.
To install the wiper motor crank arm exactly, check that the linkage is aligned with the crank arm in straight line and the angle of each linkages.
Be careful not to bend the linkage.

7. Remove the lower linkage (A) from the wiper motor crank arm.

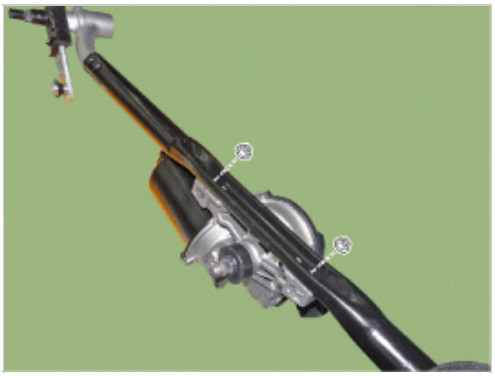


⚠ CAUTION

To install the wiper motor crank arm exactly, check that the linkage is aligned with the crank arm in straight line and the angle of each linkages.
Be careful not to bend the linkage.

8. Remove the crank arm after loosening a nut.

9. Remove the bracket after loosening the screws.



10. Remove the wiper motor from the tube.

- Installation

1. Install the wiper motor and linkage assembly and then connect the wiper motor connector.

Tightening torque :
6.9 - 10.8 Nm (0.7 - 1.1 kgf.m, 5.0 - 7.9 lbf.ft)

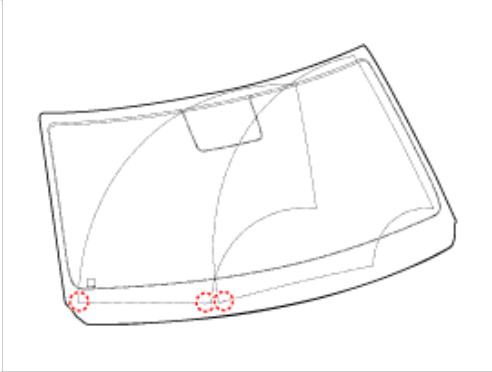
2. Install the cowl top cover.
3. Install the windshield wiper arm and blade.

Tightening torque :
22.5 - 26.5 Nm (2.3 - 2.7 kgf.m, 16.6 - 19.5 lbf.ft)

NOTICE

– The windshield wiper motor must be cycled to make sure that it is in the park position.
If necessary, adjust the wiper arm and blade.

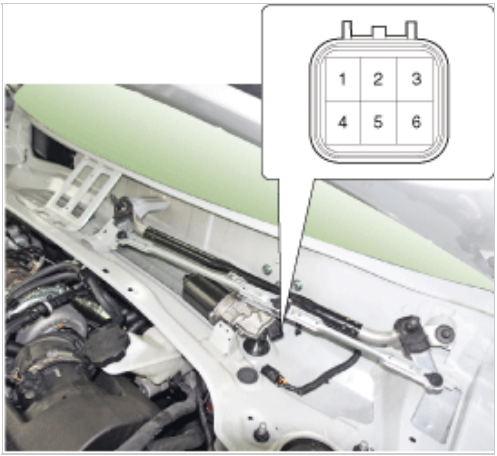
4. Install the wiper arm and blade to the specified position.
   A : Auto stop position (Blade)



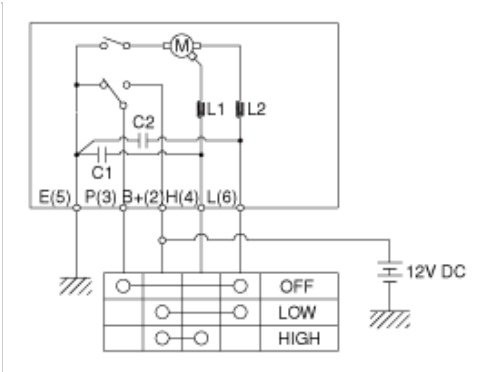
- Inspection

Speed Operation Check

1. Remove the connector (A) from the wiper motor.



2. Attach the positive (+) lead from the battery to terminal 3 and the negative (-) lead to terminal 1.
3. Check that the motor operates at low or high speed as below table.



⚠ CAUTION

Common sources of contamination are insects, tree sap, and hot wax treatments used by some commercial car washes. If the blades are not wiping properly, clean both the window and the blades with a good cleaner or mild detergent, and rinse thoroughly with clean water.

Diagnosis with Diagnostic tool

1. In the body electrical system, failure can be quickly diagnosed by using the vehicle diagnostic system (Diagnostic tool).
   The diagnostic system (Diagnostic tool) provides the following information.

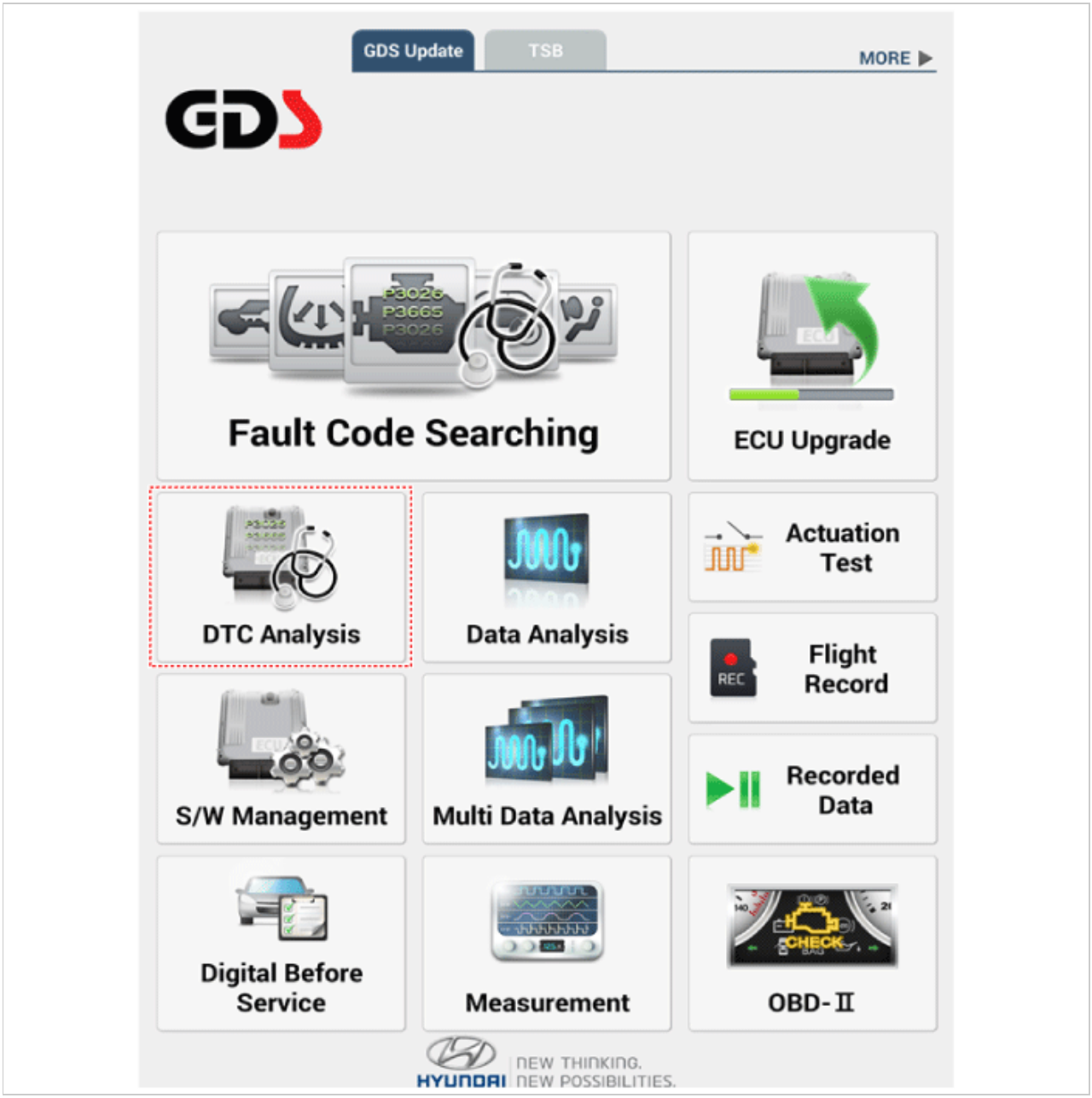
(1) Fault Code Searching : Checking failure and code number (DTC)

(2) Data Analysis : Checking the system input/output data state

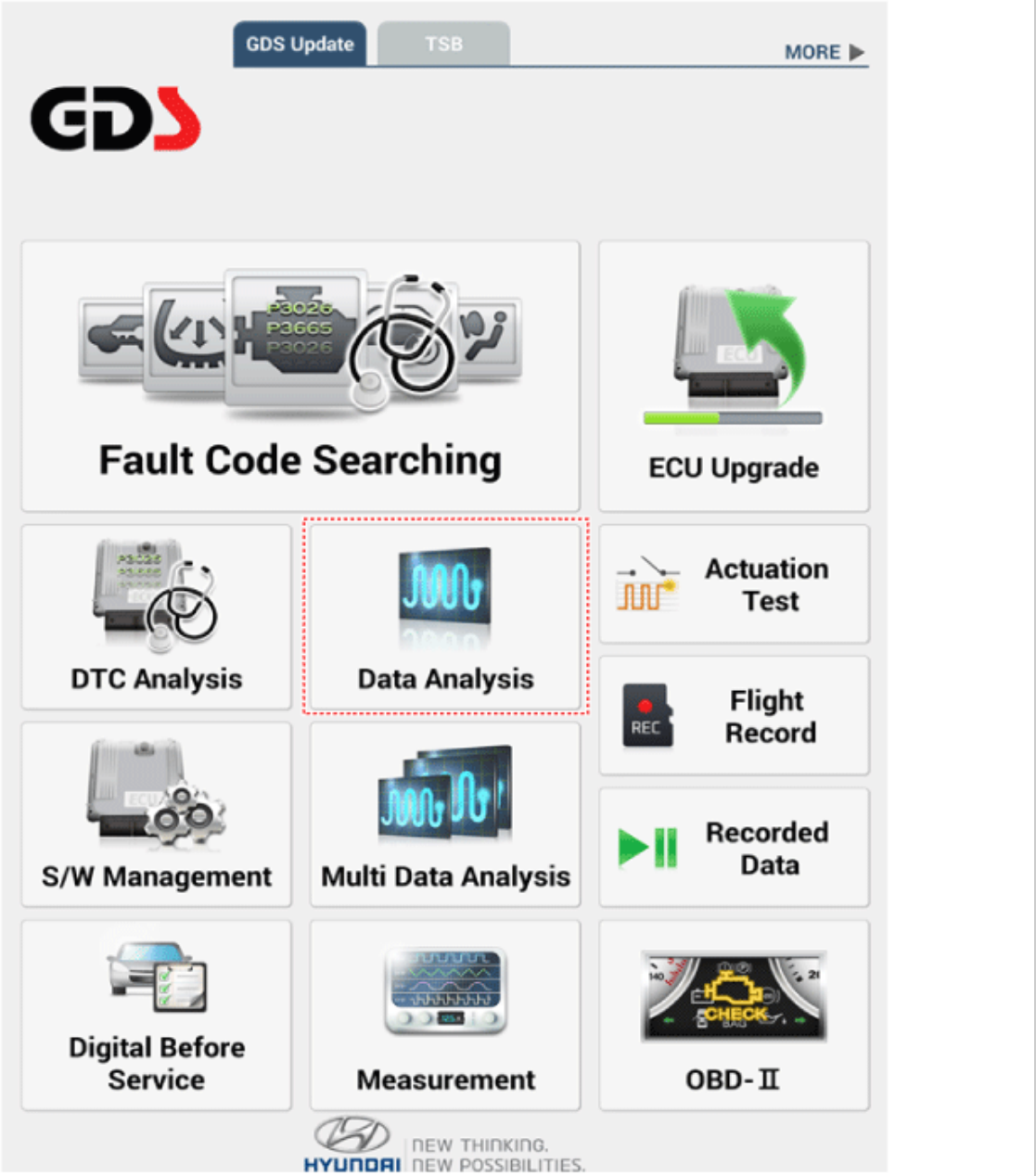
(3) Actuation test : Checking the system operation condition

(4) S/W Management : Controlling other features including system option setting and zero point adjustment

2. If diagnose the vehicle by Diagnostic tool, select "DTC Analysis" and "Vehicle".

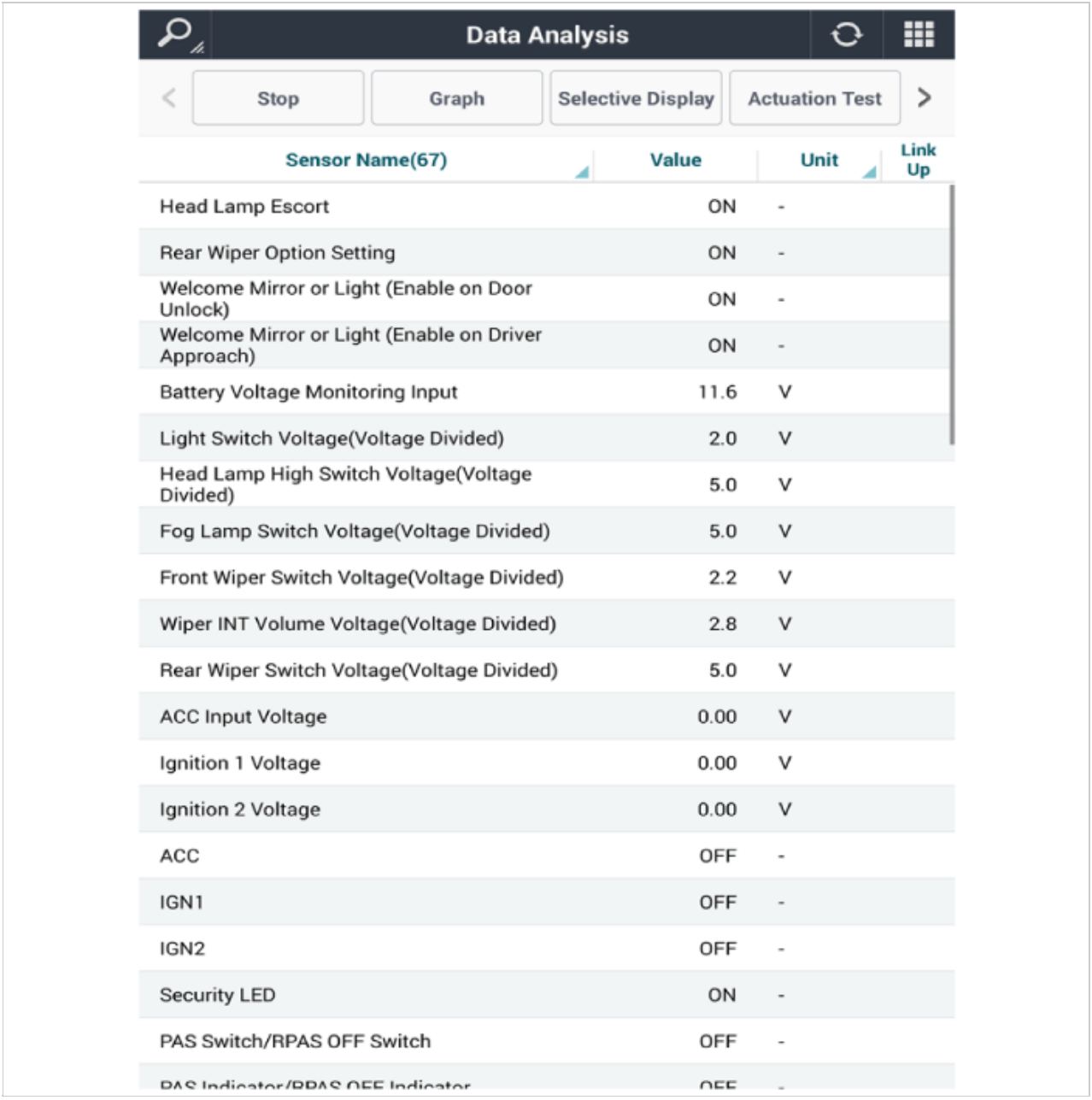


3. Select the 'Data Analysis'.



4. Select the 'IBU_BCM' to search the current state of the input/output data.

Vehicle Selection
PREV
AUTO VIN
RESET
SANTAFE(SM)
SANTAMO(M2)
D 2.2 TCI-R
System Selection
ENGINE
A / T
ABS/ESP
FCA
AIRBAG
AIRCON
4WD
EPS
RVM
SVMS
PA
BCW
FR_CMR
AFLS
AHLS
AVN
CLU
DDM
80km/h
HUD
IBU-BCM
IBU-IMMO
IBU-SMK
IBU-TPMS
PSM
System
IBU-BCM
OK


Data Analysis
Stop
Graph
Selective Display
Actuation Test
Sensor Name(67)
Value
Unit
Link Up
Head Lamp Escort ON -
Rear Wiper Option Setting ON -
Welcome Mirror or Light (Enable on Door Unlock) ON -
Welcome Mirror or Light (Enable on Driver Approach) ON -
Battery Voltage Monitoring Input 11.6 V
Light Switch Voltage(Voltage Divided) 2.0 V
Head Lamp High Switch Voltage(Voltage Divided) 5.0 V
Fog Lamp Switch Voltage(Voltage Divided) 5.0 V
Front Wiper Switch Voltage(Voltage Divided) 2.2 V
Wiper INT Volume Voltage(Voltage Divided) 2.8 V
Rear Wiper Switch Voltage(Voltage Divided) 5.0 V
ACC Input Voltage 0.00 V
Ignition 1 Voltage 0.00 V
Ignition 2 Voltage 0.00 V
ACC OFF -
IGN1 OFF -
IGN2 OFF -
Security LED ON -
PAS Switch/RPAS OFF Switch OFF -

- Inspection

Front and Rear Washer Motor

1. With the washer motor connected to the reservoir tank, fill the reservoir tank with water.

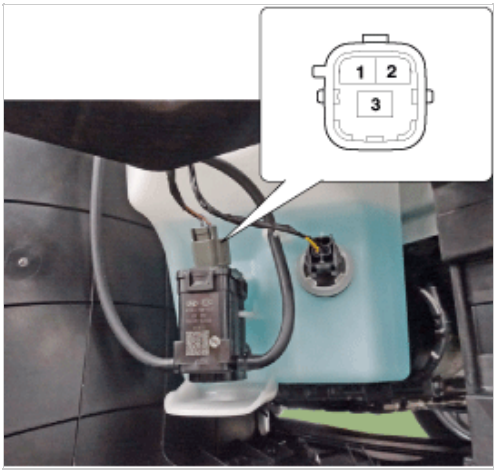
> **NOTICE**
> Before filling the reservoir tank with water, check the filter for foreign material or contamination. if necessary, clean the filter.

2. Connect positive (-) battery cables to terminal 1 and negative (+) battery cables to terminal 2 respectively.
3. Check that the motor operates normally and the washer motor runs and water sprays from the front nozzles.
4. If they are abnormal, replace the washer motor.

[Standard Type]

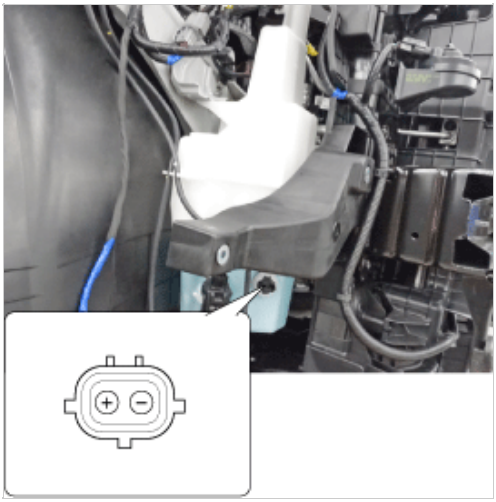
No	Description
1	Windshield washer (+)

2	Ground
3	Rear washer (+)



Washer Fluid Level Sensor Switch

1. Disconnect the negative(-) battery terminal.
2. Drain the washer fluid less than 650 cc.
3. Check for continuity between the No. 1 and No.2 terminal in each float position.
   There should be continuity when the float is down.
   There should be no continuity when the float is up.
4. If the continuity is not as specified, replace the washer fluid level switch



Terminal / Position	1	2
Over 650cc		
Under 650cc	○	○

(Tolerance : -50cc ~ +100cc)

- Removal

⚠ CAUTION

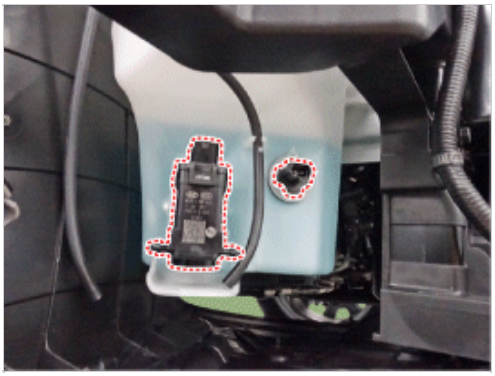
– When servicing the washer pump, be careful not to damage the washer pump seal.

– Do not operate the washer pump before filling the washer reservoir.
Failure to do so could result in premature pump failure.

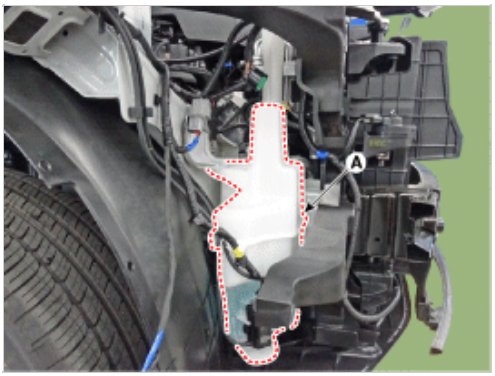
1. Disconnect the negative (-) battery terminal.

2. Remove the front bumper cover.
   (Refer to Body - "Front Bumper Cover")
3. Separate the washer hose and then disconnect the motor and level sensor connector.

4. Remove the washer motor and level sensor.



5. Remove the washer reservoir (A) after loosening bolts .



- Installation

1. Reassemble the washer reservoir.

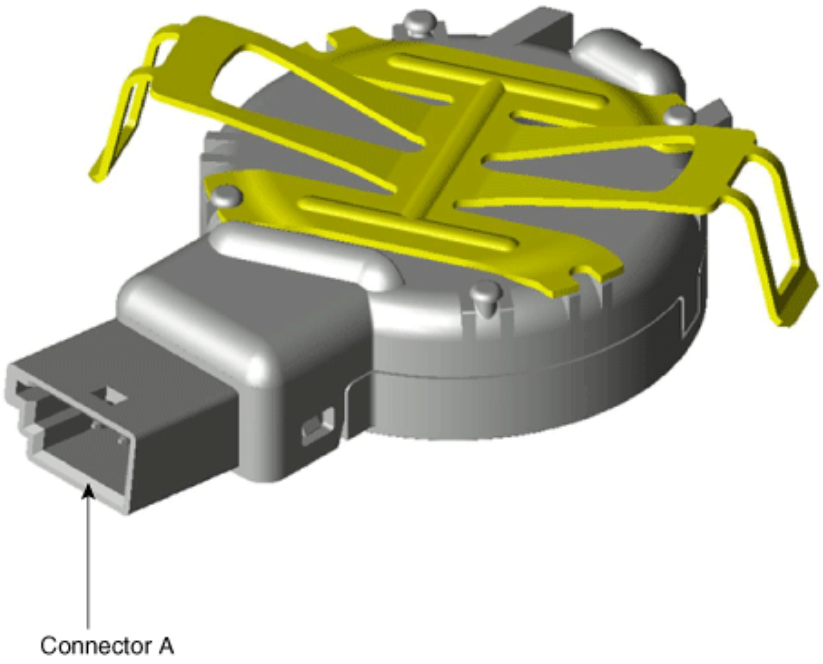
Tightening torque (Bolt) :
3.9 - 5.9 Nm (0.4 - 0.6 kgf.m, 2.9 -4.3 lbf.ft)

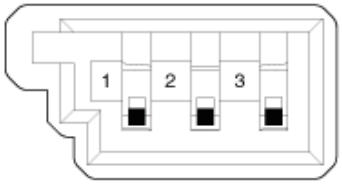
NOTICE

- Before installing the pump motor, check the filter for foreign material or contamination. if necessary, clean the filter into the pump motor.

2. Install the washerlever sensor and washer motor.
3. Connect the washer motor connector and washer hose.
4. Install front bumper cover.

- Components



Connector A	No.	Description
	1	Battery (+)
	2	LIN
	3	GND

- Description

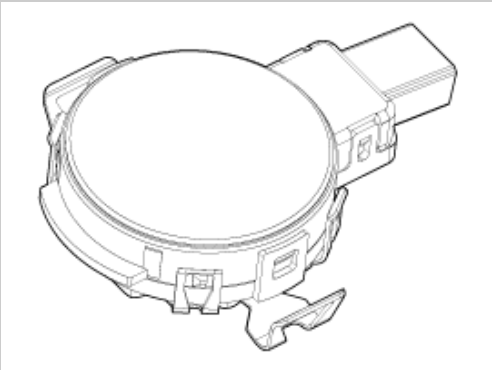
Integrated Rain Sensor

Integrated rain sensor (A) controls three systems: front wiper, auto-light, and central air conditioner.

1. Wiper Control System

   When "AUTO" switch signal is received from the multi-function switch on the right, the integrated rain sensor detects the amount of rainfall. The sensor is installed inside the upper part of the front window for wiper motor control.

   This system automatically controls the operation duration and speed of the wiper depending on the measured amount of rainfall even if the driver does not operate the wiper switch.



- Functions and Operating Principles

Basic Principle

1. Detecting the amount of rainfall

   The light (beam) emitted from light emitting diodes (LED) is totally reflected on the external surface of the windshield and comes back to the photo diodes. When there is water on the external surface of the windshield, the light is optically separated and reflected partially and the remaining brightness is measured by the photo diodes. Water remaining on the windshield results in the light being not totally reflected. The loss of brightness due to this indicates how much the glass surface is wet.

Interference

Rain sensor might malfunction due to the interferences listed below.

1. Dust on the measuring surface and other surfaces on the light path (surface of light emitting diodes and photo diodes, fiber optics, bracket, and glass surface of windshield joint area) weakens the received light.
2. Movement of windshield and bracket
3. Movement of bracket due to vibration
4. Damaged wiper blade

NOTICE

• When the integrated rain sensor does not operate or malfunctions, the driver should operate the wiper switch manually.

Automatic Operation

1. Operational status of rain sensor

Operation Mode	Operation
Direct Mode	It is the normal operational status of the integrated rain sensor when the wiper switch is in "Auto" and the sensor detected dry windshield. Based on this state, integrated rain sensor determines the operation mode of wiper depending on the rainfall and its duration.
Intermittent Mode	Integrated rain sensor activates the intermittent mode when wiper operation is done successively more than twice with a pause of 0.5 - 5 seconds.
Low Speed	The wiper operates continuously in low speed
High Speed	The wiper operates continuously in high speed

Safety Function

1. When there is ice or foreign matter in the detecting area, integrated rain sensor cannot recognize the condition for operation correctly.

Detecting Special Conditions

1. Rain sensor

Special Condition	Operation based on special conditions detecting
Splash	When integrated rain sensor detects a high level of water (splash) in Direct or Intermittent mode, the system switches from Park to High speed. Then, wiping is done once in High speed and once more in Low speed. If the condition of rainfall does not change after wiping, it returns to the original condition (Direct or Intermittent).

Smearing	Smearing is a thin oil film that has dried fast and occurs when a small amount of rainfall is wiped by a dirty or worn-out wiper blade. Operational signal should not be issued when smearing occurs in Direct or Intermittent mode.
Dirt	When no change is detected after wiping, integrated rain sensor determines that the windshield is dirty. In this state, operational signal should not be issued. If the windshield becomes clean (for example, by washer fluid), the integrated rain sensor returns to the normal condition.
Washer fluid	Integrated rain sensor does not respond to the washer fluid during the Washer mode. In other words, wiping speed does not change even if the washer fluid is sprayed (automatic operation of the washer pump is not reflected in the functioning of integrated rain sensor).

- Removal

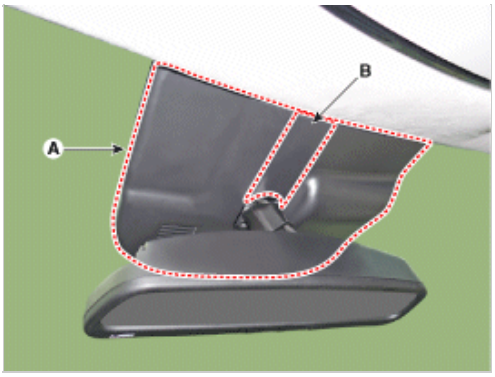
CAUTION

- Do not damage or touch the silicone (coupling medium).
- Be careful so that the silicon is not contaminated by foreign substances, dust, etc. .
- Use caution, as the silicon may be damaged if you try to separate the rain sensor forcibly.

Information

- The dust or foreign substance on the rain sensor may have bad influence on the performanec of the rain sensor. In order to ensure accurate function of the rain sensor, protect the sensor surface with the protection cover until the sensor is installed on the bracket.
- The coupling pad on the rain sensor surface is adhesive and the coupling pad may stick to the windshield during the use depending on the environment condition.
  Therefore, it may be damaged when you try to remove the rain sensor from the windshield forcibly. Use caution when sepearting it from the windshield.

1. Remove the rain sensor cover (A) & (B).



2. To remove the latch, pull aside the latch using the cover hole with a small flat-blade screwdriver.

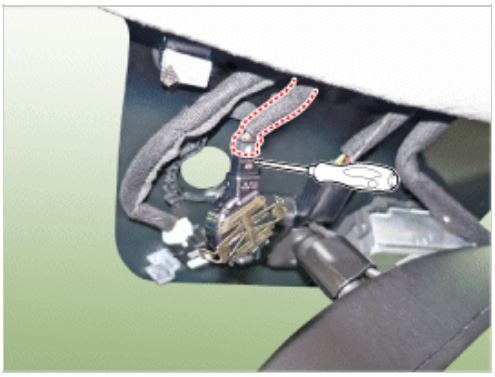
Click to see large image...

3. Remove the rain sensor.
   1) Insert a small flat-blade screwdriver (-) into a space at the bottom(B) or top(A), between the rain sensor and bracket. .
   2) Pull the rain sensor slowly up and down in the vertical direction of the glass, then disassemble the rain sensor slowly from windshield without damaging the silicone on the sensor.

⚠ CAUTION

- It may be damaged when you try to remove the rain sensor from the windshield forcibly. Use caution when sepearting it from the windshield.
- When detaching the silicone under a high temperature, it may be easily damaged because of the adhesive strength of the silicone. Remove the silicone in a cool enviroment.

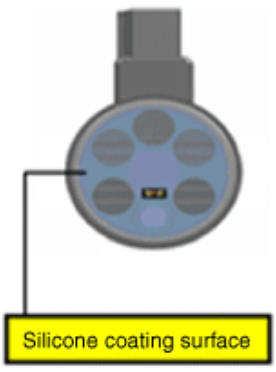
4. Disconnect the wiring harness connector (B) from the rain sensor by inserting a small flat-blade screwdriver (A) into the space.



- Installation

⚠ CAUTION

- Check the operation of the rain sensor and the light sensor before mounting.
  - Check the sensor for silicon damage.
  - Check whether the rain sensor connector is tightened.
  - Check whether the rain sensor and bracket are properly tightened.
  - Check whether the sensor mounted area is free from foreign matters.
  - Recalibrate sensitivity of the swtich if the auto-wiping operation is insensitivity or too much sensitive.



- In case the silicone of the rain sensor is normal or slightly damaged as shown in the below images, it can be reused.

Normal	Damage within 1.5 mm of outer part

• In case the silicone of the rain sensor is damaged as shown in the below images, it should be replaced with a new silicone.

Foreign substances	Fingerprint	Damege

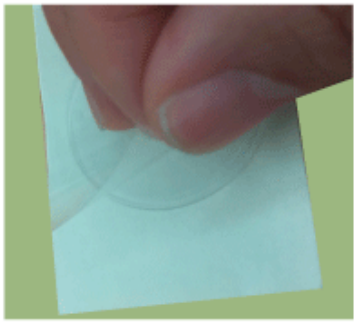
Damege		
	Click to see large image...	Click to see large image...

• In case the silicone of the rain sensor is damaged it should be replaced it as shown below.
1) Remove the damaged silicone gel pad from the lens plate completely.

NOTICE

- Be careful not to damage or contaminate the surface of the lens plate during removal.

2) Attach the new silicone gel pad aftet removing the silicone paper (A) then remove the transperent film (B).



NOTICE

- When attaching the silicone gel pad to the sensor, be careful not to contaminate

• It is very important that the silicon (coupling pad) is completely pushed against the windshield and stuck without any air bubble.

Click to see large image...

- In case of replacing the damaged windshield, you may reuse the undamaged exisitng rain sensor.
- The windshield glass has to be clean and free of contamination or foreign substances.

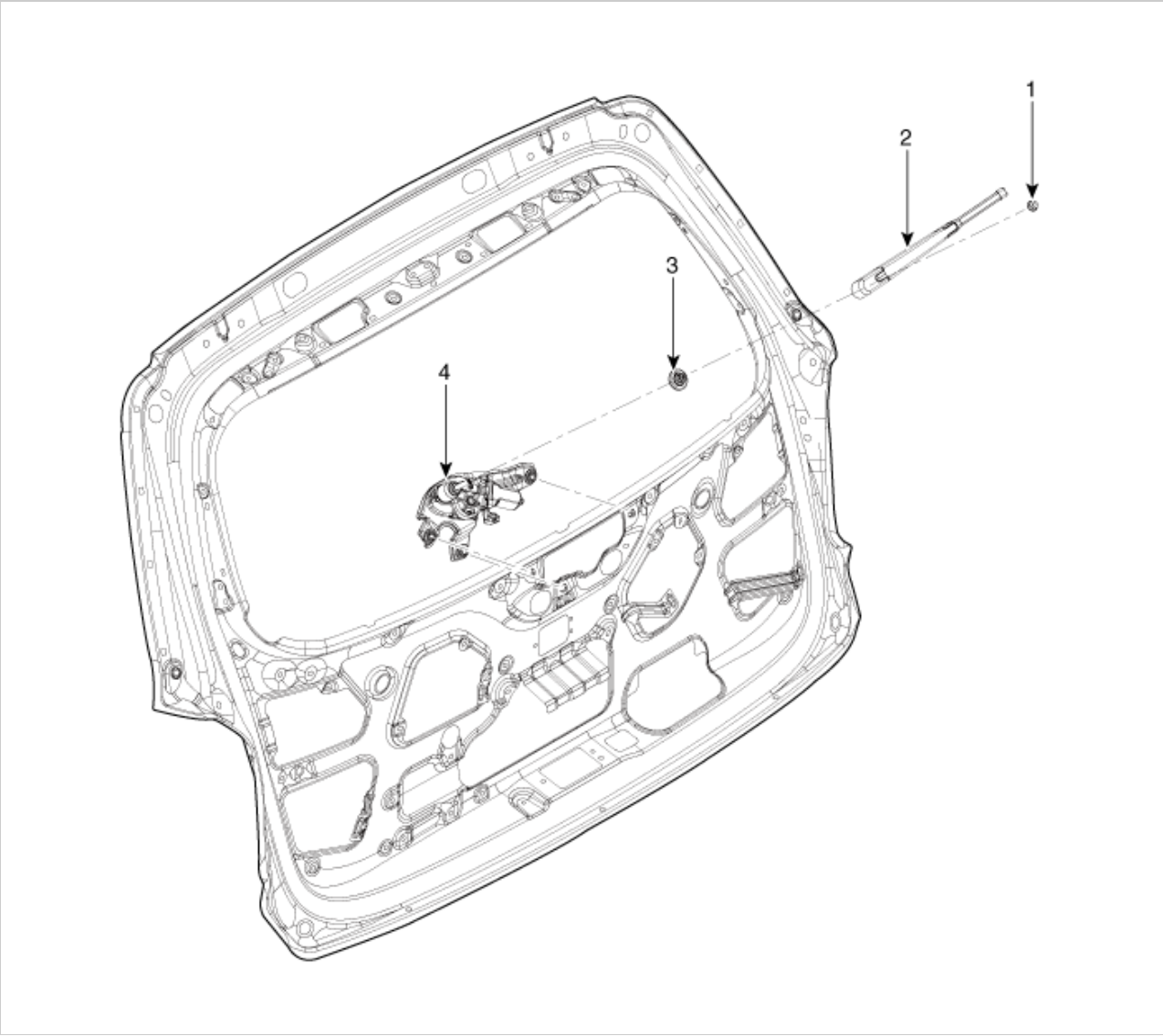
1. Connect the rain sensor connector.
2. Push one of the latch of spring arm (A) down until it snaps and you hear a click sound.
   And then push the latch of second spring arm (B) for keeping the sensor in right position.

Click to see large image...

⚠ CAUTION

- Do not snap both spring arms at the same time.
- An incorrectly mounted snap connection may cause malfunctions of the rain/light sensor.

- Component Location



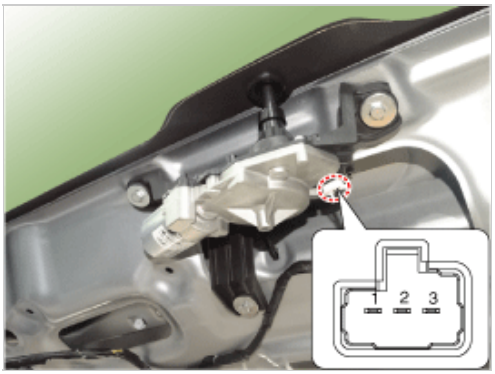
1. Rear wiper arm nut
2. Rear wiper arm & blade
3. Rear wiper grommet
4. Rear wiper motor assembly

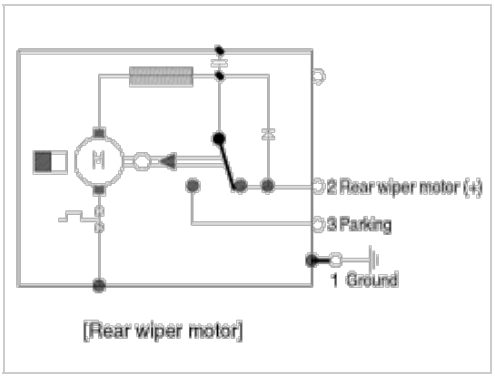
- Inspection

Rear Wiper Motor

1. Remove the connector from the rear wiper motor.
2. Connect battery positive (+) and negative (-) cables to terminals 2 and 1 respectively.
3. Check that the motor operates normally. Replace the motor if it operates abnormally.

No	Description
1	Ground
2	Rear wiper motor (+)
3	Parking





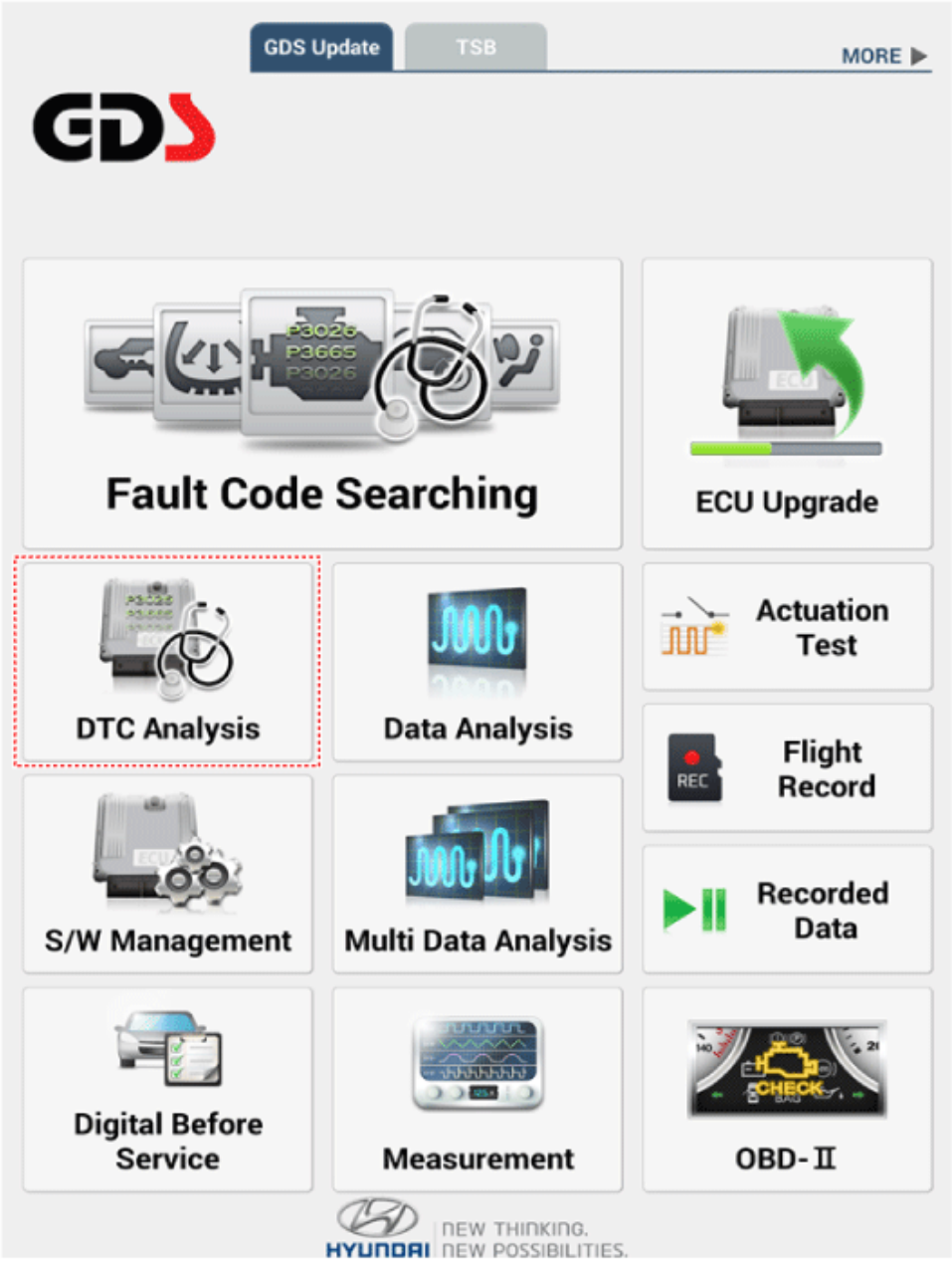
Automatic Stop Operation Check

1. Operate the motor at low speed using the stalk control.
2. Stop the motor operation anywhere except at the off position by disconnecting terminal 3.
3. Connect the positive (+) lead from the battery to terminal 3 and the negative (-) lead to terminal 1.
4. Check that the motor stops running at the off position.

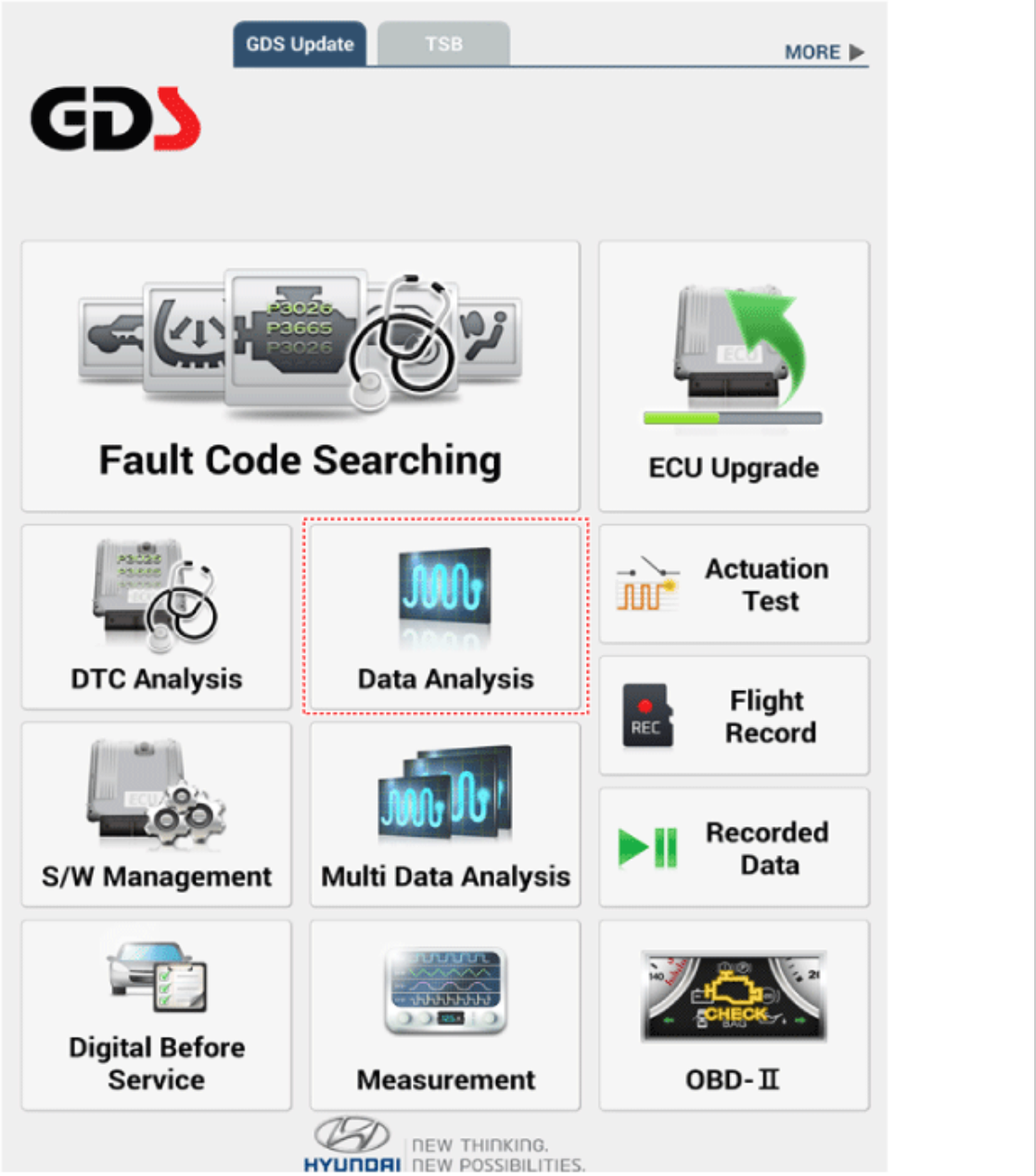
Click to see large image...

Diagnosis with Diagnostic tool

1. In the body electrical system, failure can be quickly diagnosed by using the vehicle diagnostic system (Diagnostic tool).
   The diagnostic system (Diagnostic tool) provides the following information.
   (1) Fault Code Searching : Checking failure and code number (DTC)
   (2) Data Analysis : Checking the system input/output data state
   (3) Actuation test : Checking the system operation condition
   (4) S/W Management : Controlling other features including system option setting and zero point adjustment
2. If diagnose the vehicle by Diagnostic tool, select "DTC Analysis" and "Vehicle".

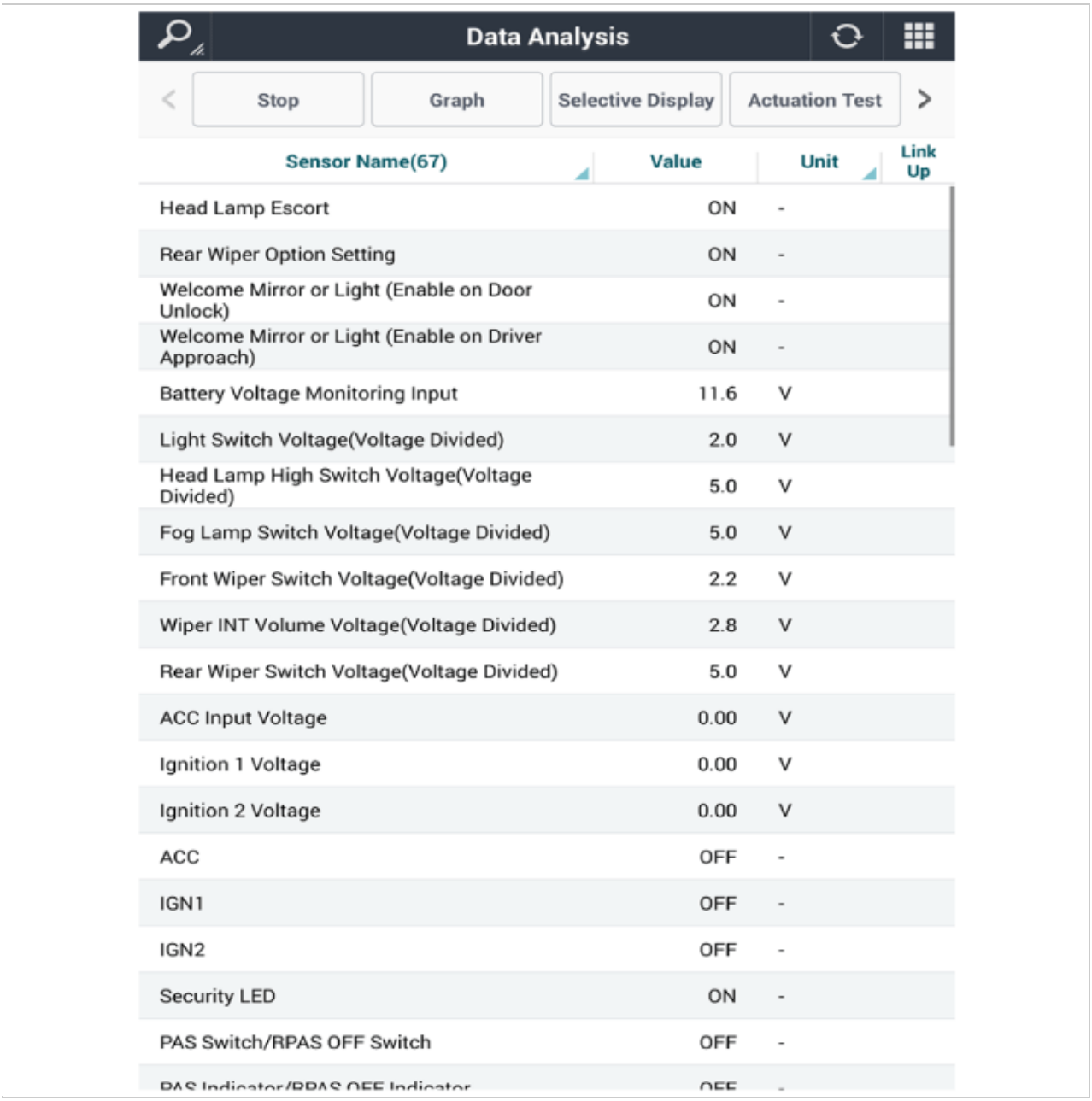


3. Select the 'Data Analysis'.



4. Select the 'IBU_BCM' to search the current state of the input/output data.

Vehicle Selection
PREV
AUTO VIN
RESET
SANTAFE(SM)
SANTAMO(M2)
D 2.2 TCI-R
System Selection
ENGINE
A / T
ABS/ESP
FCA
AIRBAG
AIRCON
4WD
EPS
RVM
SVMS
PA
BCW
FR_CMR
AFLS
AHLS
AVN
CLU
DDM
80km/h
HUD
IBU-BCM
IBU-IMMO
IBU-SMK
IBU-TPMS
PSM
System
IBU-BCM
OK

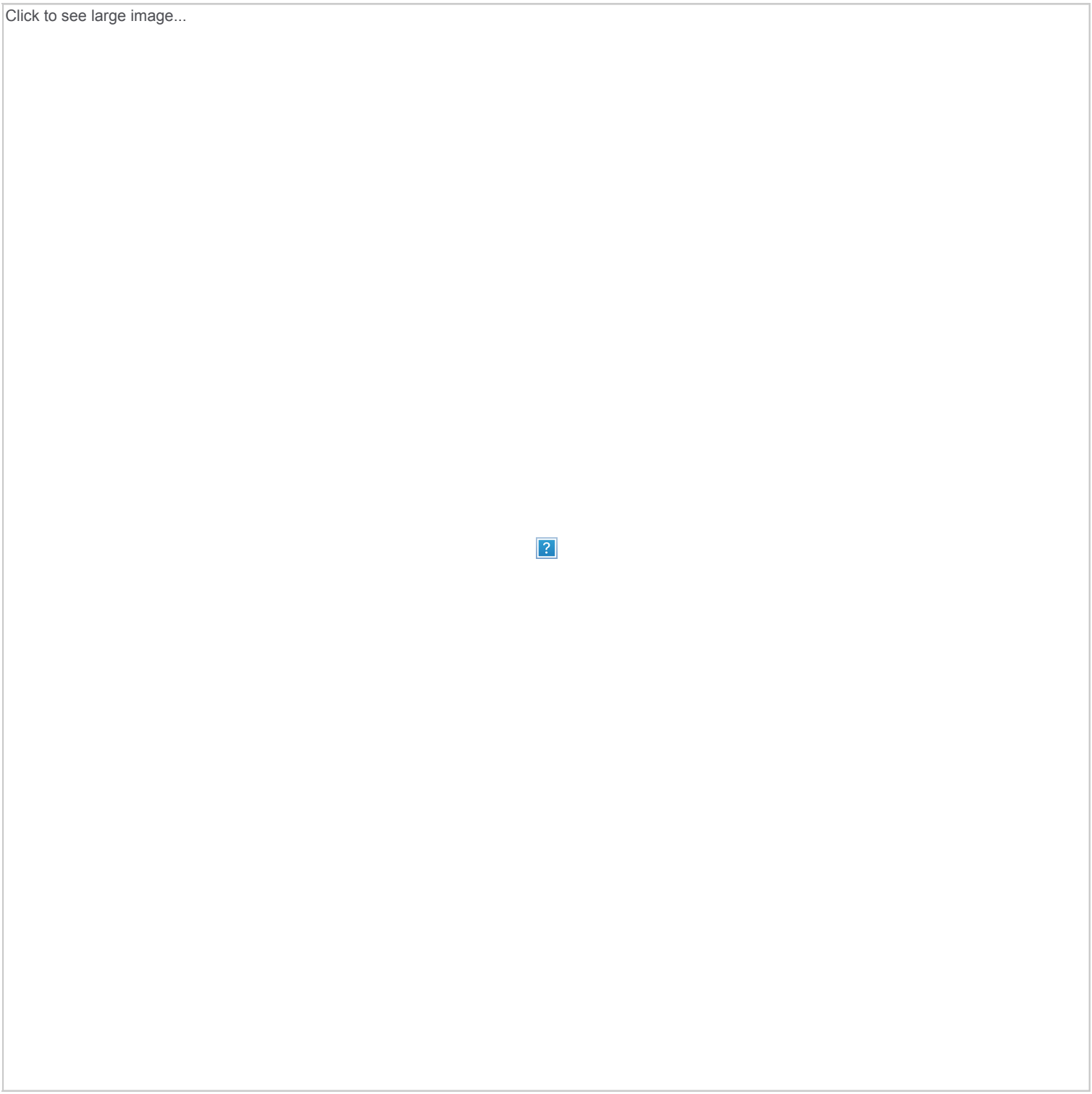


Sensor Name(67)	Value	Unit	Link Up
Head Lamp Escort	ON	-	
Rear Wiper Option Setting	ON	-	
Welcome Mirror or Light (Enable on Door Unlock)	ON	-	
Welcome Mirror or Light (Enable on Driver Approach)	ON	-	
Battery Voltage Monitoring Input	11.6	V	
Light Switch Voltage(Voltage Divided)	2.0	V	
Head Lamp High Switch Voltage(Voltage Divided)	5.0	V	
Fog Lamp Switch Voltage(Voltage Divided)	5.0	V	
Front Wiper Switch Voltage(Voltage Divided)	2.2	V	
Wiper INT Volume Voltage(Voltage Divided)	2.8	V	
Rear Wiper Switch Voltage(Voltage Divided)	5.0	V	
ACC Input Voltage	0.00	V	
Ignition 1 Voltage	0.00	V	
Ignition 2 Voltage	0.00	V	
ACC	OFF	-	
IGN1	OFF	-	
IGN2	OFF	-	
Security LED	ON	-	
PAS Switch/RPAS OFF Switch	OFF	-	
PAS Indicator/RPAS OFF Indicator	OFF	-	

- Removal

1. Disconnect the negative (-) battery terminal.
2. Detach the rear wiper cap (A).

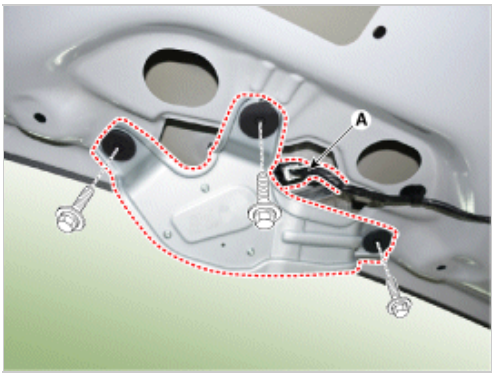
Click to see large image...



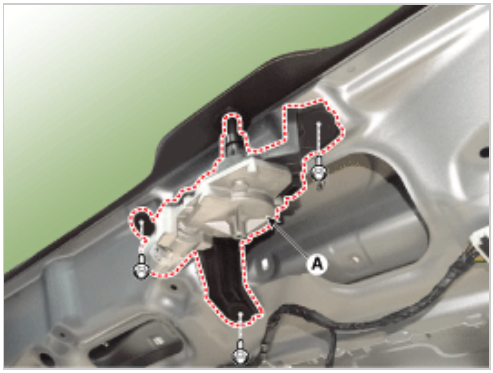
3. Remove the rear wiper arm & blade (A) after removing rear wiper nut.

Click to see large image...

4. Remove the tailgate trim.
   (Refer to Body - "Tailgate Trim")
5. Disconnect the motor connector (A).



6. Remove the rear wiper motor (A) after loosening bolts .



- Installation

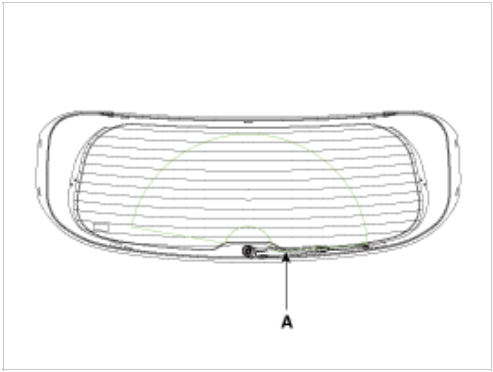
1. Install the rear wiper motor assembly.

   Tightening torque Nut :
   6.9 - 9.8 Nm (0.7 - 1.0 kgf.m, 5.0 - 7.2 lbf.ft)

2. Install the tailgate trim.
3. Install the rear wiper arm cap after tighting the nut.

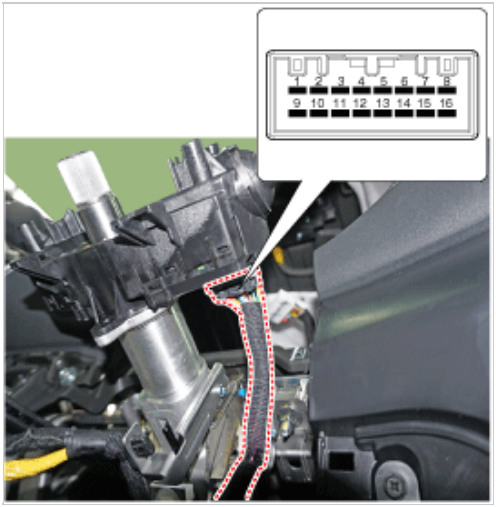
   Tightening torque Bolt :
   8.8 - 12.7 N.m (0.9 - 1.3 kgf.m, 6.5 - 9.4 lb.ft)

4. Set the rear wiper blade and to the lowest defogger heat line and tailgate glass.



- Inspection

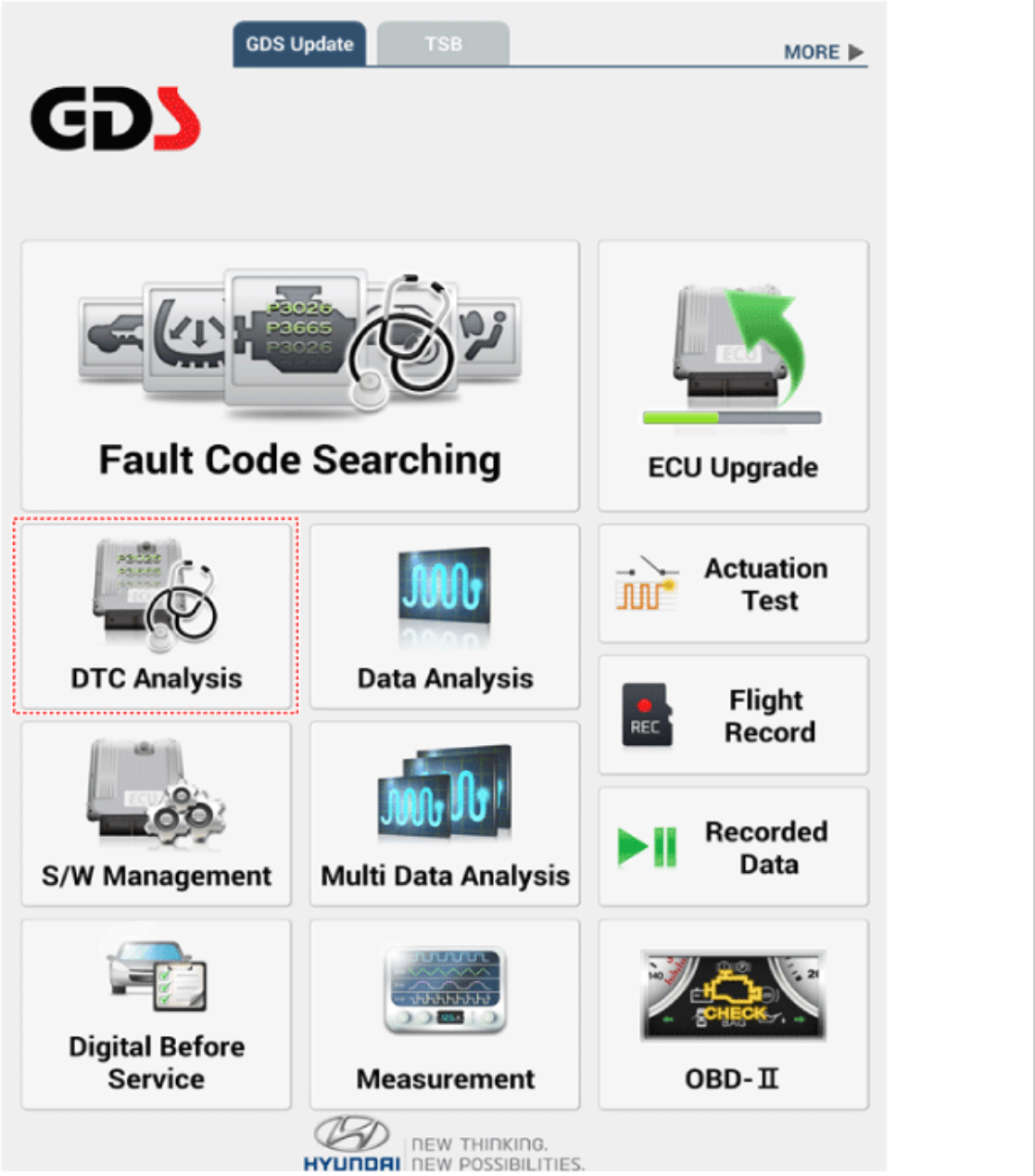
1. Check for continuity between the terminals in each switch position as shown below.



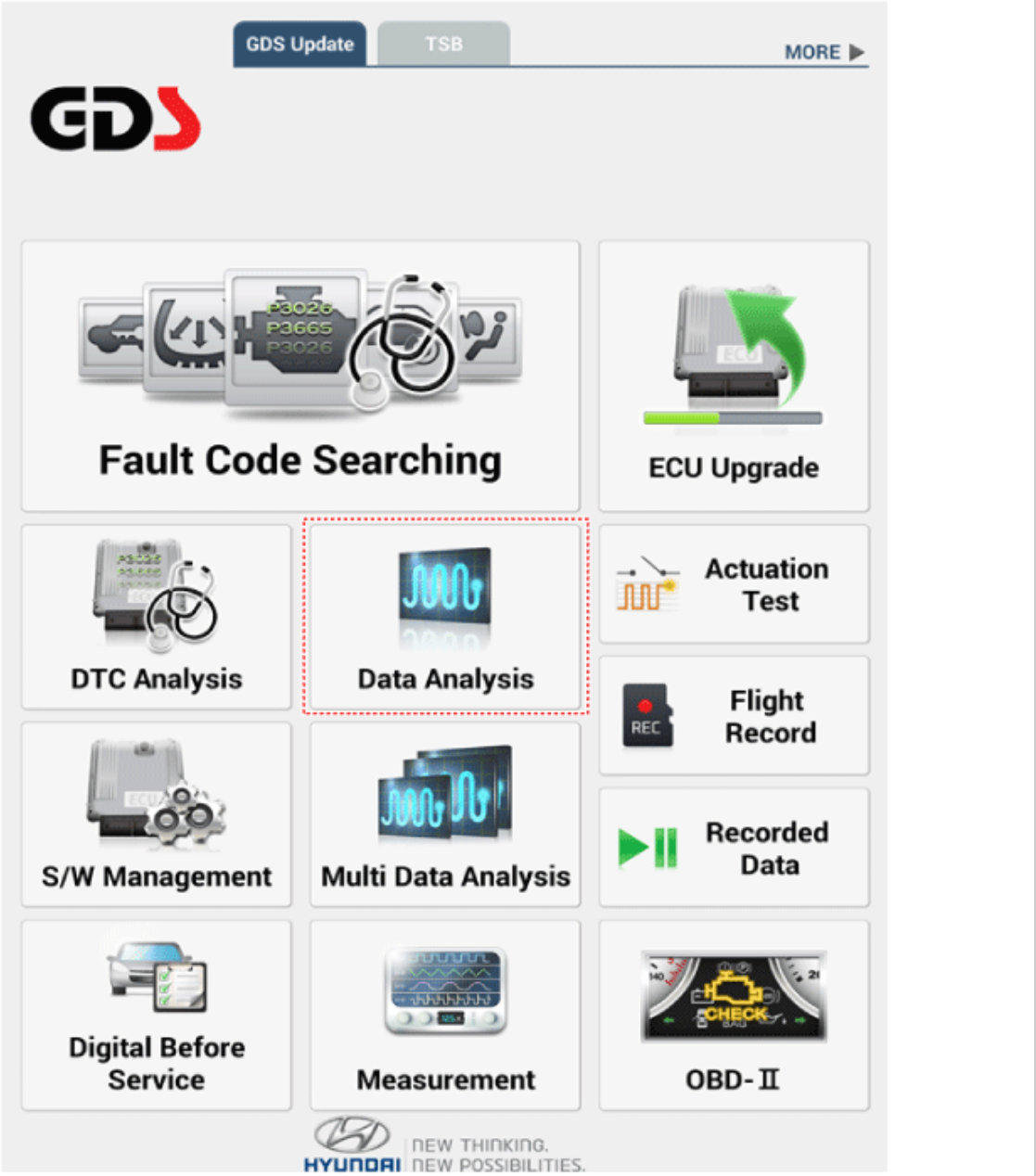
Switch	Switch position	Switch terminal	Resistance (Ω, ±3.5%)
Front wiper switch	MIST	1-9	330
	OFF		∞
	INT (AUTO)		800
	LOW		1800
	HIGH		5700
Front wiper intermittent volume	Volume 1	7-9	330
	Volume 2		690
	Volume 3		1310
	Volume 4		2610
	Volume 5		7310
Rear wiper switch	OFF	4-16	∞
	LOW		910
	HIGH		2000
Fog lamp switch	OFF	9-10	∞
	Front foglamp		910
	Rear foglamp		2910
Turn signal switch	OFF	9-12	∞
	Left		910
	Right		2910
Dimmer & Passing switch	OFF	9-13	∞
	Passing		910
	Dimmer		2910
Light switgh	OFF	9-14	680
	AUTO / DRL		∞
	Tail lamp		1680
	Low beam		5580

Inspection (With Diagnostic tool)

1. In the body electrical system, failure can be quickly diagnosed by using the vehicle diagnostic system (Diagnostic tool).
   The diagnostic system (Diagnostic tool) provides the following information.
   (1) Fault Code Searching : Checking failure and code number (DTC)
   (2) Data Analysis : Checking the system input/output data state
   (3) Actuation test : Checking the system operation condition
   (4) S/W Management : Controlling other features including system option setting and zero point adjustment
2. If diagnose the vehicle by Diagnostic tool, select "DTC Analysis" and "Vehicle".

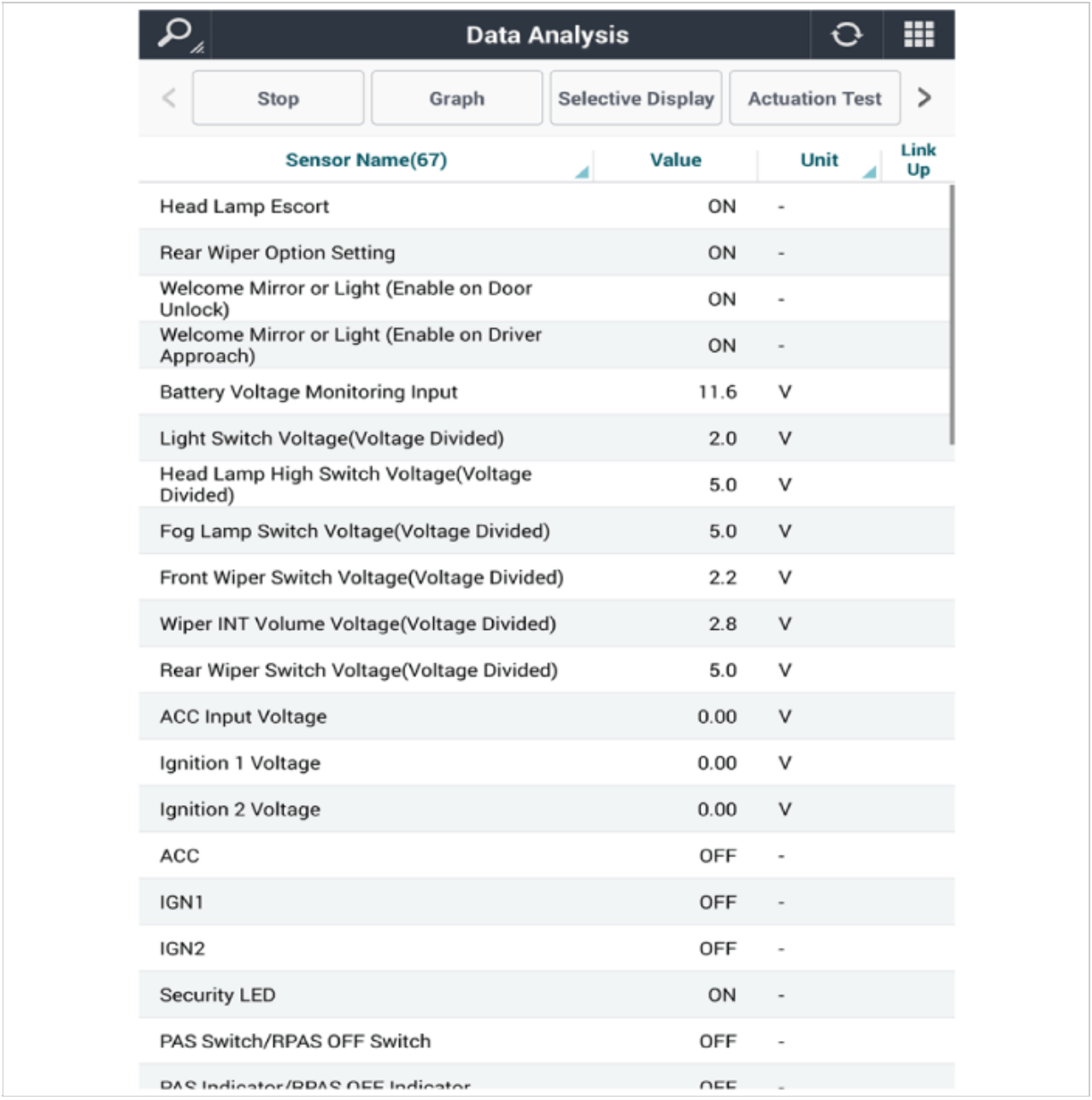


3. If check current status, select the "Data Analysis" .



4. Select the 'IBU_BCM' to search the current state of the input/output data.

Vehicle Selection
PREV
AUTO VIN
RESET
SANTAFE(SM)
SANTAMO(M2)
D 2.2 TCI-R
System Selection
ENGINE
A / T
ABS/ESP
FCA
AIRBAG
AIRCON
4WD
EPS
RVM
SVMS
PA
BCW
FR_CMR
AFLS
AHLS
AVN
CLU
DDM
80km/h
HUD
IBU-BCM
IBU-IMMO
IBU-SMK
IBU-TPMS
PSM
System
IBU-BCM
OK


Data Analysis
Stop
Graph
Selective Display
Actuation Test
Sensor Name(67)
Value
Unit
Link Up
Head Lamp Escort ON -
Rear Wiper Option Setting ON -
Welcome Mirror or Light (Enable on Door Unlock) ON -
Welcome Mirror or Light (Enable on Driver Approach) ON -
Battery Voltage Monitoring Input 11.6 V
Light Switch Voltage(Voltage Divided) 2.0 V
Head Lamp High Switch Voltage(Voltage Divided) 5.0 V
Fog Lamp Switch Voltage(Voltage Divided) 5.0 V
Front Wiper Switch Voltage(Voltage Divided) 2.2 V
Wiper INT Volume Voltage(Voltage Divided) 2.8 V
Rear Wiper Switch Voltage(Voltage Divided) 5.0 V
ACC Input Voltage 0.00 V
Ignition 1 Voltage 0.00 V
Ignition 2 Voltage 0.00 V
ACC OFF -
IGN1 OFF -
IGN2 OFF -
Security LED ON -
PAS Switch/RPAS OFF Switch OFF -

- Inspection

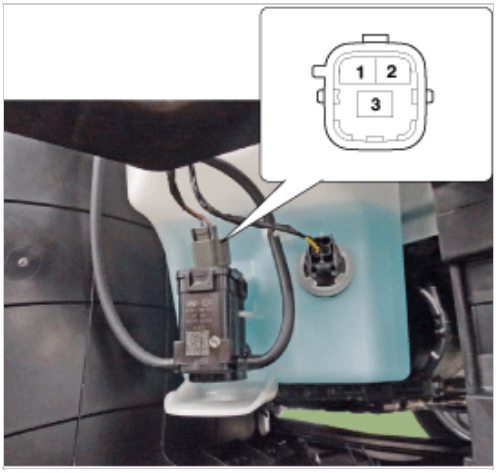
1. With the washer motor connected to the reservoir tank, fill the reservoir tank with water.

> **NOTICE**
> Before filling the reservoir tank with water, check the filter for foreign material or contamination. if necessary, clean the filter.

2. Remove the front bumper cover.
   (Refer to Body - "Front Bumper Cover")
3. Connect positive (+) and negative (-) battery cables to terminals 3 and 2 respectively to see that the washer motor runs and water is pumped.
4. Check that the motor operates normally.
   Replace the motor if it operates abnormally.

No	Description
1	Ground
2	Windshield washer (+)

3	Rear washer (+)



- Components

ECM

Click to see large image...

Home Link + ECM

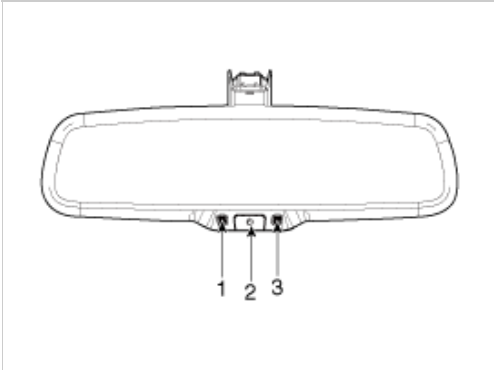
Click to see large image...

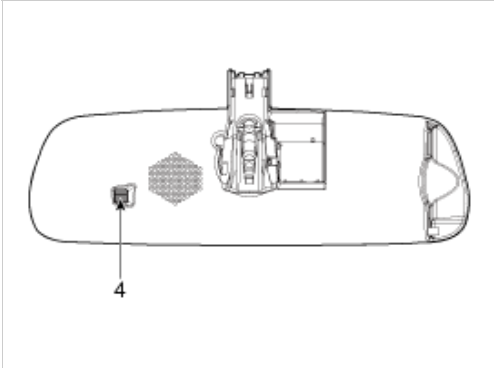
- Description

The ECM (Electro Chromatic inside rear view Mirror) is intended dim the reflecting light in the rear view mirror. The forward facing sensor detects brightness of the surroundings, while the rearward looking sensor is for the light from the rear. The strength of the light in the rear sensor is used by the mirror to adjust the shading. It ranges from 7 to 85%. When the reverse gear is engaged, it stops functioning.

1. The forward facing sensor sees if the brightness of the surroundings is low enough for the mirror to operate its function.
2. The rearward looking sensor detects glaring of the reflecting light from a vehicle behind.
3. The ECM is darkened to the level as determined by the rearward looking sensor. When the glaring is no longer detected, the mirror stops functioning.

(1. LED indicator , 2. ON/OFF Switch , 3. Rearward looking sensor , 4. Forward looking sensor)





- Automatic-dimming Function

To protect your vision during nighttime driving, your mirror will automatically dim upon detecting glare from the vehicles traveling behind you. The auto-dimming function can be controlled by the Dimming ON/OFF Button :

1. Pressing and holding the Feature Control button for more than 3 but less than 6 seconds turns the auto-dimming function OFF which is indicated by the green Status Indicator LED turning off.
2. Pressing and holding the Feature Control button again for more than 3 but less than 6 seconds turns the auto-dimming function ON which is indicated by the green Status Indicator LED turning on.

> **NOTICE**
> The mirror defaults to the "ON" position each time the vehicle is started.

- Inspection

Check it by the procedure below to see if the function of the ECM is normal.

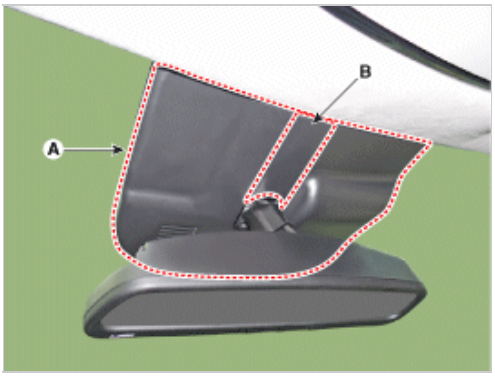
1. Turn the ignition key to the "ON" position.
2. Cover the forward facing sensor.
3. Head a light to the rearward looking sensor.
4. The ECM should be darkened as soon as the rearward looking sensor detects the light.

> **NOTICE**
> If this test is performed in daytime, the ECM may be darkened as soon as the forward facing sensor is covered.

5. When the reverse gear is engaged, the ECM should not be darkened.
   When heading lights to both the forward facing and rearward looking sensors, the ECM should not be darkened.

- Removal

1. Disconnect the negative (-) battery terminal.
2. Remove the mirror wiring cover (A) and (B).



3. Remove the mirror mounting screw and connector (A).
4. Remove the mirror pulling up in the arrow direction.

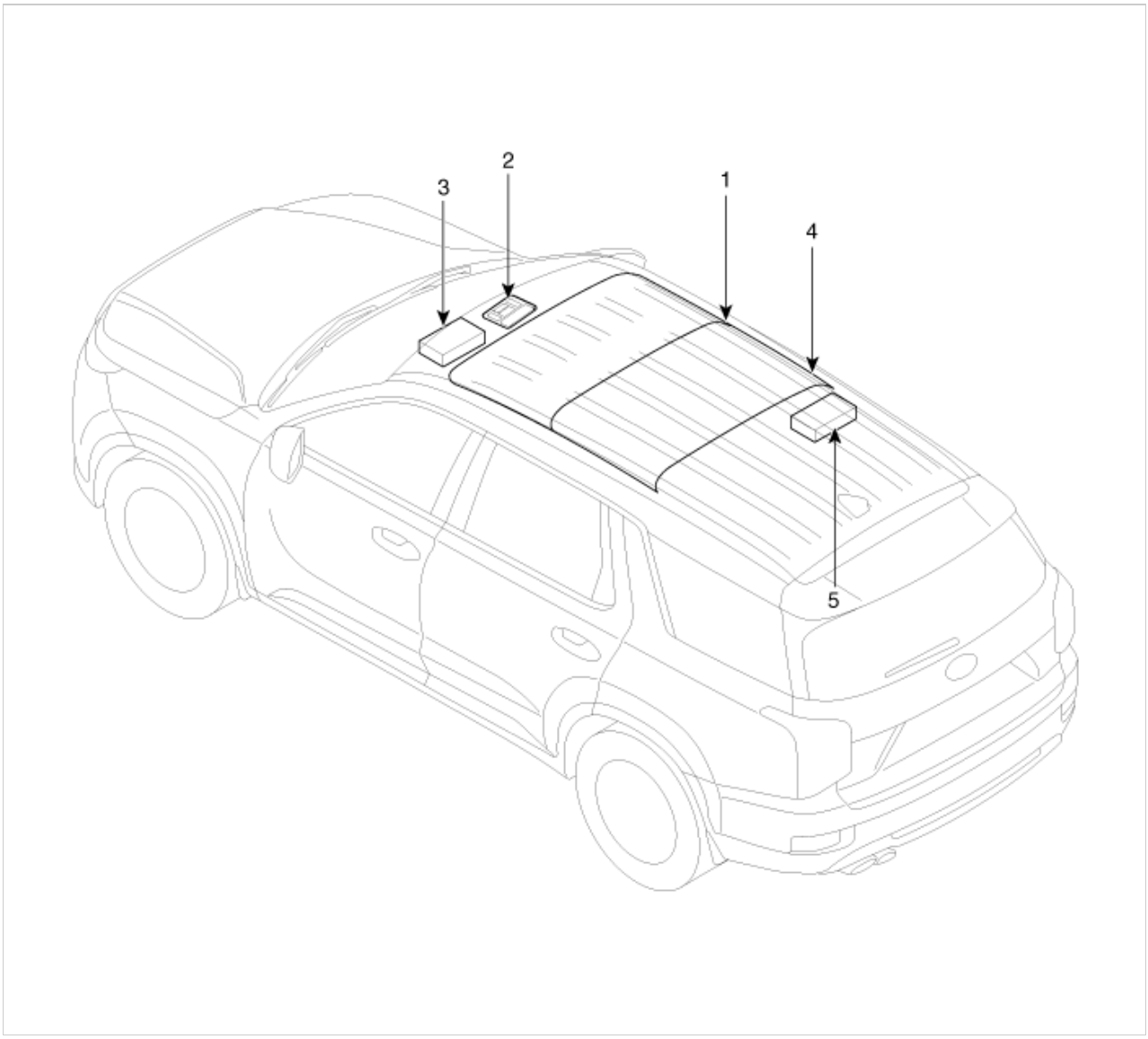
> **NOTICE**
> Make sure not to damage the mounting bracket when removing the mirror.

Click to see large image...

- Installation

1. Install the mirror making sure the mounting bracket not to be damaged.
2. Install the mirror wiring cover after reconnecting the connector and tightening the screw.

- Component Location



1. Sunroof
2. Sunroof switch
3. Sunroof motor & controller
4. Roller blind
5. Roller blind motor

- Circuit Diagram

Sunroof

Click to see large image...

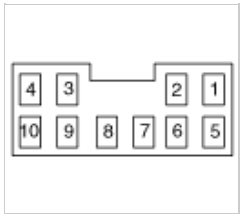
Roller blind

Click to see large image...

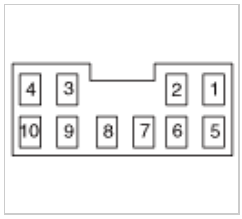
Connector Pin Information

Sunroof

	Wire harness connector	Sunroof motor

No		Click to see large image...
1	Ground	Ground
2	Open switch	Open switch (SIG A)
3	ICU Enable	ICU Enable
4	Tilt up switch	Tilt up switch
5	Close switch	LIN Bus
6	Battery (+)	Battery (+)
7	Open alarm switch	Open alarm switch
8	Vehicle speed	Vehicle speed
9	-	Config pin
10	-	Close switch (SIG B)

Roller blind

No	Wire harness connector	Sunroof motor
		Click to see large image...
1	Ground	Ground

2	Open switch	Open switch (SIG A)
3	ICU Enable	ICU Enable
4	-	-
5	Close switch	LIN Bus
6	Battery (+)	Battery (+)
7	-	-
8	-	-
9	-	Config pin
10	-	Close switch (SIG B)

- Inspection

1. Disconnect the negative (-) battery terminal.
2. Open the sunglass case cover from the overhead console then remove screws (2EA).

Click to see large image...

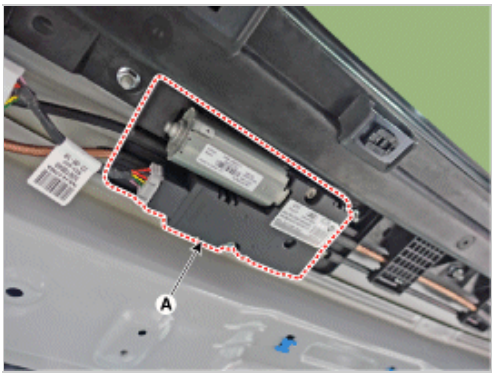
3. Check for continuity between the terminals. If the continuity is not as specified, replace the sunroof switch.

Click to see large image...

- Replacement

1. Disconnect the negative (-) battery terminal.
2. Remove the roof trim assembly.
   (Refer to Body - "Roof Trim Assembly")
3. Remove the sunroof motor mounting screws (3EA). And then remove the sunroof motor (A) after disconnecting the connector.

[Sunroof Motor]



4. Remove the blind motor mounting screws (3EA). And then remove the blind motor (A) after disconnecting the connector.

[Blind Motor]

Resetting The Sunroof

Whenever the vehicle battery is disconnected or discharged, or you use the emergency handle to operate the sunroof, you have to reset yoursunroof system as follows :

Information

You need to reset the sunroof motor to its default settings for the following cases :

- The sunroof motor loses battery power temporarily because the battery or fuse is replaced or the battery has died.
- The automatic opening or closing of the sunroof, a one-touch feature, does not function properly.
- The sunroof reopens during automatic closing even if there is no object caught in the sunroof (safety feature)

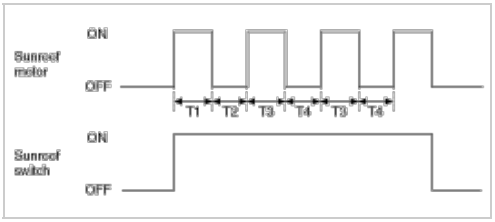
1. Turn the ignition key to the ON position and then close the sunroof completely.
2. Release the sunroof control lever.
3. Press and hold the CLOSE button for more than 10 seconds until the sunroof has moved slightly.
4. Release the sunroof control lever.
5. Press and hold the CLOSE button once again within 5 seconds until thesunroof do as follows ;
   • Blind open and glass open → Glass close → Blind close
   Then release the lever.
6. Reset procedure of sunroof system is finished.

Protecting The Overheated Motor

In order to protect the overheated sunroof motor by continuous motor operation, the sunroof ECU controls the Run-time and Cool-time of motor as followings;

1. The sunroof ECU detects the Run- time of motor
2. Motor can be operated continuously for the 1st Run-time(120 ± 10sec.).
3. Motor which is operated continuously stops operating after the 1st Run-time(120 ± 10sec.).
4. And then Motor is not operated for the 1st Cool-time(18 ± 2sec.).
5. Motor is operated for the 2nd Run-time(10 ± 2sec.) at the continued motor operation after 1st Cool-time(18 ± 2sec.)

6. Motor which is operated continuously stops operating after the 2nd Run-time(10 ± 2sec.)
7. Motor is not operated for the 2nd Cool-time(18 ± 2sec.).
8. Motor repeats the 2nd Run-time and 2nd Cool-time at the continued motor operation.
   – In case that motor is not operated continuously, the Run-time which is limited for protecting the overheated motor is increased.
   – The Run-Time of motor is initialized to "0" if the battery or fuse is reconnected after being disconnected, discharged or blown.



T1 : 120 ± 10 sec., T2 : 18 ± 2 sec.,
T3 : 10 ± 2 sec., T4 : 18 ± 2 sec.

- Specifications

Items			Bulb Type	Bulb Wattage (W)
Front	Head lamp (STD)	Low	9005L+	60
		High	H7LL	55
	Head lamp (LED)	Low	LED	LED
		High	LED	LED
	Turn signal lamp		LED	LED
	Position lamp		LED	LED
	Daytime Running Lamp (DRL)		LED	LED
	Door mirror turn signal lamp		LED	LED
Rear	High mounted stop lamp		LED	LED
	Rear combination lamp	Stop lamp	28/8W	LED
		Tail lamp	28/8W	LED
		Turn signal lamp	28/8W	LED
	Back up lamp		PY21W	21
License plate lamp			W5W	5
Cargo lamp			BULB/LED	FESTOON 8W/LED
Map lamp			BULB/LED	W8WB/LED
Room lamp			BULB/LED	W8WB/LED
Vanity lamp			BULB/LED	FESTOON 5W/LED

- Component Location

Click to see large image...

1. Head lamp (Low)
2. Head lamp (High)
3. Head lamp (Spread Low)
4. Head lamp (Hot spot Low)
5. Head lamp (Sub Low/High)
6. DRL / Position lamp
7. Turn signal lamp
8. Over head console lmap
9. Room lamp
10. Cago lamp
11. Door mirror turn signal lamp
12. Vanity lamp

Click to see large image...

1. Tail lamp
2. Turn signal lamp
3. Bulb : Tail/Stop lamp, LED : Stop lamp
4. License plate lamp
5. High mounting stop lamp
6. Back up lamp
7. Side maker lamp

- Removal

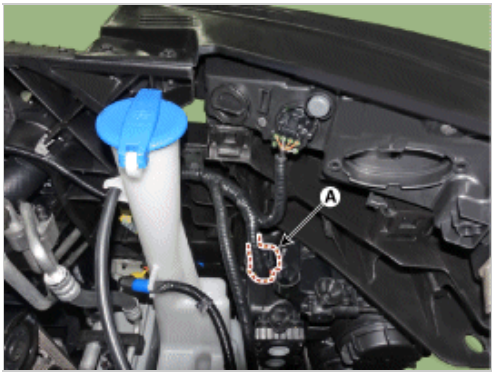
CAUTION

Head lamps become very hot during use; do not touch them or any attaching hardware immediately after they have been turned off.

NOTICE

The headlamp bulb should not be removed from the headlamp assembly until just before a new bulb is installed.
Removing bulb for an extended period of time may affect headlamp bulb performance.
Contaminants may enter the headlamp assembly where they can settle on the lens and reflector.
Never turn on the head lamps with the bulb removed from the headlamp assembly.

1. Disconnect the negative (-) battery terminal.
2. Remove the front bumper cover.
   (Refer to Body - "Front Bumper Cover")
3. Disconnecting the lamp connectors (A).



4. Loosen the mounting bolts and then remove the head lamp assembly (A).

Click to see large image...

NOTICE

Take care that retaining clip (A) is not to be damaged.

5. Remove the dust caps (A) from the headlamp assembly after turning in the counterclockwise direction.

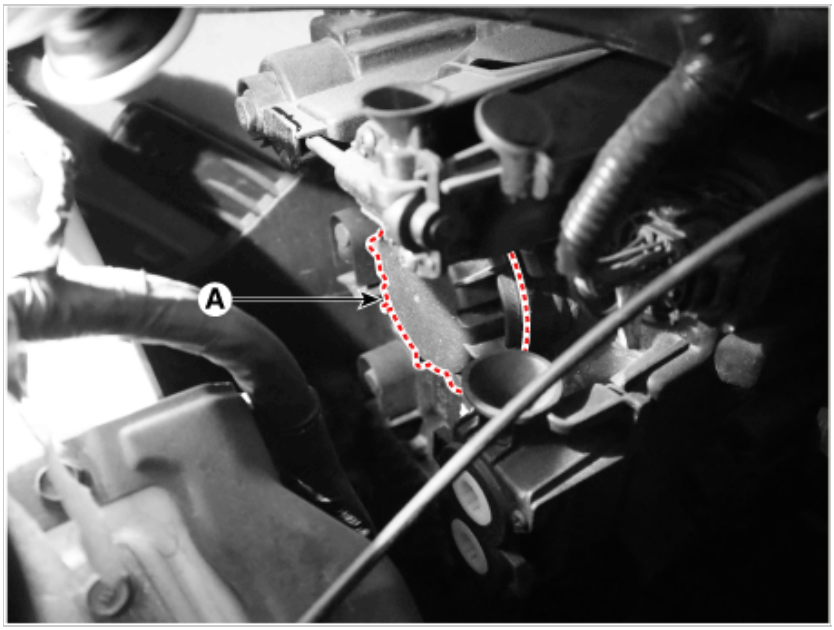
Click to see large image...

6. Disconnect the connector and then remove the bulb.

- Replacement

Moisture absorbent of the head lamp

1. Remove the dust cap (A).



2. Remove the bracket (A), after removing screws.

3. Replace the moisture-absorbing (A).

Click to see large image...

⚠ CAUTION

- Grasp the moisture absorbent and form a round shape.
- Do not insert the moisture absorbent folded.

Correct	Incorrect

Click to see large image...	Click to see large image...
Click to see large image...	Click to see large image...

- Careful to ensure that the moisture absorbent packaging is not damaged when fastening the screws.

- Installation

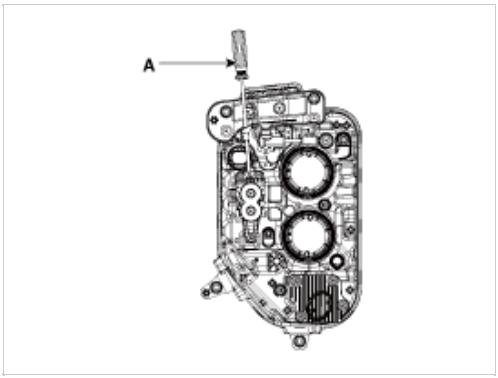
1. Install the head lamp bulb.
2. Install the dust cover.
3. Install the head lamp assembly after connecting the lamp connector.

- Head Lamp Aiming Instructions

1. Alternately turn the adjusting gear to adjust the head lamp aiming. If beam-setting equipment is not available, proceed as follows :
2. The vehicle should be placed on a flat ground.s
3.

Draw vertical lines (Vertical lines passing through respective head lamp centers) and a horizontal line (Horizontal line passing through center of head lamps) on the screen.

4. With the head lamp and battery in normal condition, aim the head lamps so the brightest portion falls on the horizontal and vertical lines.
   A : Vertical (High beam / Low beam)



Head Lamp And Fog Lamp Aiming Point

Click to see large image...

Information

- Headlamp aiming for low beam center reference

Click to see large image...

1. Head Lamp (Low beam)
   - Turn the high beam on without driver aboard.
   - The cut-off line should be projected in the cut-off line shown in the picture.
   - When aiming the low beam, vertical aiming shuld be adjusted after adjusting the horizontal aiming.
   - If head lamp leveling device is equipped, adjust the head lamp leveling device switch with 0 positions.

Click to see large image...

Head lamp fogging

Check the below instruction procedure when the head lamp is fogged.

Click to see large image...

- Removal

Door mirror turn signal lamp

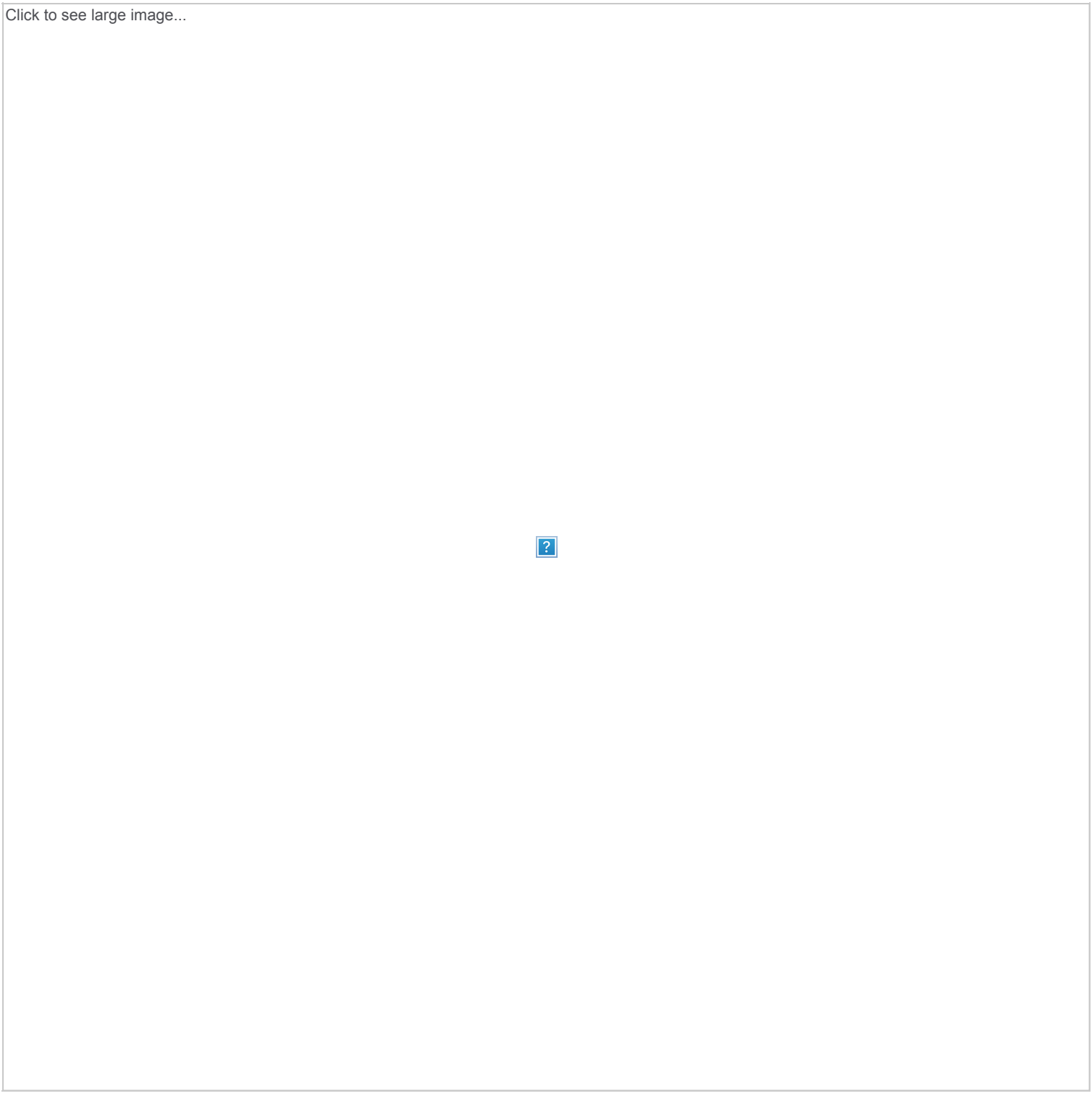
CAUTION

- Put on gloves to prevent hand injuries.
- When removing with a flat-tip screwdriver or remover, wrap protective tape around the tools to prevent damage to components.

1. Disconnect the negative (-) battery terminal.

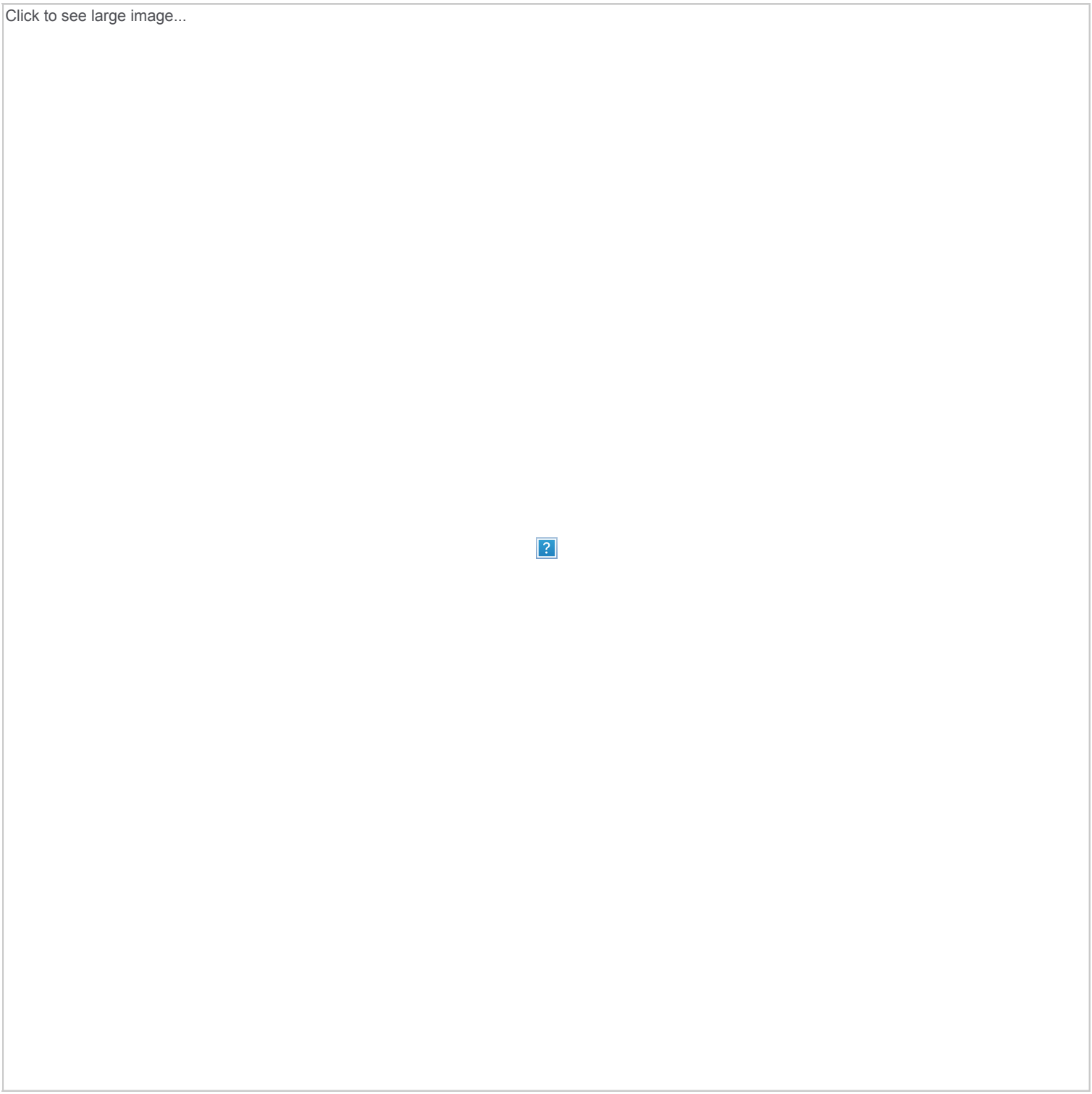
2. Remove the front door trim.
   (Refer to Body - "Front Door Trim")
3. Remove the outside rear view mirror cover (A).

Click to see large image...



4. Disconnect the rear view mirror connector (A).

Click to see large image...



5. Loosen the mounting nuts and then remove the outside rear view mirror.

Click to see large image...

Front turn signal lamp

1. Disconnect the negative (-) battery terminal.
2. Remove the DRL connector (A).

Click to see large image...

3. Remove the DRL after loosening the mounting bolts.

Click to see large image...

Rear turn signal lamp

1. Disconnect the negative (-) battery terminal.
2. Remove the rear combination lamp.
   (Refer to Lighting System - "Rear Combination Lamp")

- Installation

Outside Rear View Mirror Turn Signal Lamp

1. Install the outside mirror assembly and then connect the connector.

2. Connect the negative (-) battery terminal.

Front turn signal lamp

1. Install the DRL.
2. Connect the DRL connector.
3. Connect the negative (-) battery terminal.

Rear turn signal lamp

1. Install the rear combination lamp.
2. Connect the negative (-) battery terminal.

- Removal

Room lamp

1. Disconnect the negative (-) battery terminal.
2. Detach the lamp lens (A) from the room lamp with a flat-tip screwdriver.

Click to see large image...

3. Separate the room lamp from the roof trim after loosening the screws.

Click to see large image...

4. Remove the room lamp after disconnecting the connector (A).

Click to see large image...

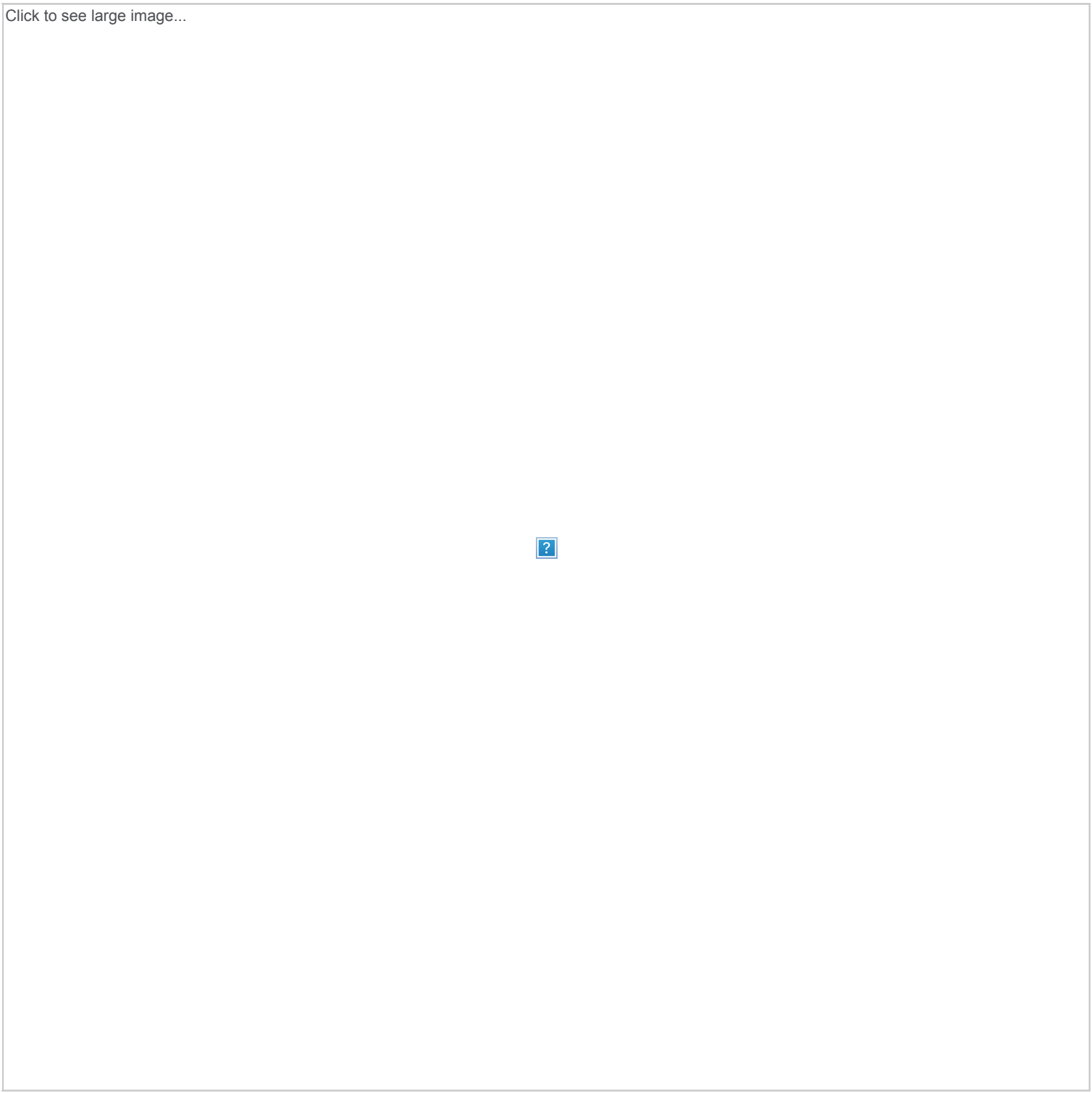
Vanity lamp

1. Disconnect the negative (-) battery terminal.
2. Using a flat-tip screwdriver, remove the vanity lamp.

Click to see large image...

3. Disconnect the connecotr (A).

Click to see large image...



- Installation

Room lamp

1. Install the room lamp after connecting the lamp connector.
2. Connect the negative (-) battery terminal.

Vanity lamp

1. Install the vanity lamp after connecting the lamp connector.
2. Connect the negative (-) battery terminal.

- Circuit Diagram

Click to see large image...

Click to see large image...

- Inspection

1. Remove the overhead console lamp connector (A) then check for continuity between terminals. If the continuity is not as specified, replace the map lamp switch.

Click to see large image...

- Removal

1. Disconnect the negative (-) battery terminal.
2. Remove the mounting screws (2EA).
   And then remove the overhead console.

Click to see large image...

3. Remove the overhead console after disconnect the connector.

Click to see large image...

- Installation

1. Install the overhead console lamp after connecting the connector.
2. Install the lens after tightening 2 screws.

- Removal

1. Disconnct the negative (-) battery terminal.
2. Remove the audio/AVN keyboard assembly.
   (Refer to Audio - "Audio Keyboard Assembly")

(Refer to AVN System - "AVN Keyboard Assembly")

- Installation

1. Install the audio/AVN keyboard assembly.
2. Connect the negative (-) battery terminal.

- Components

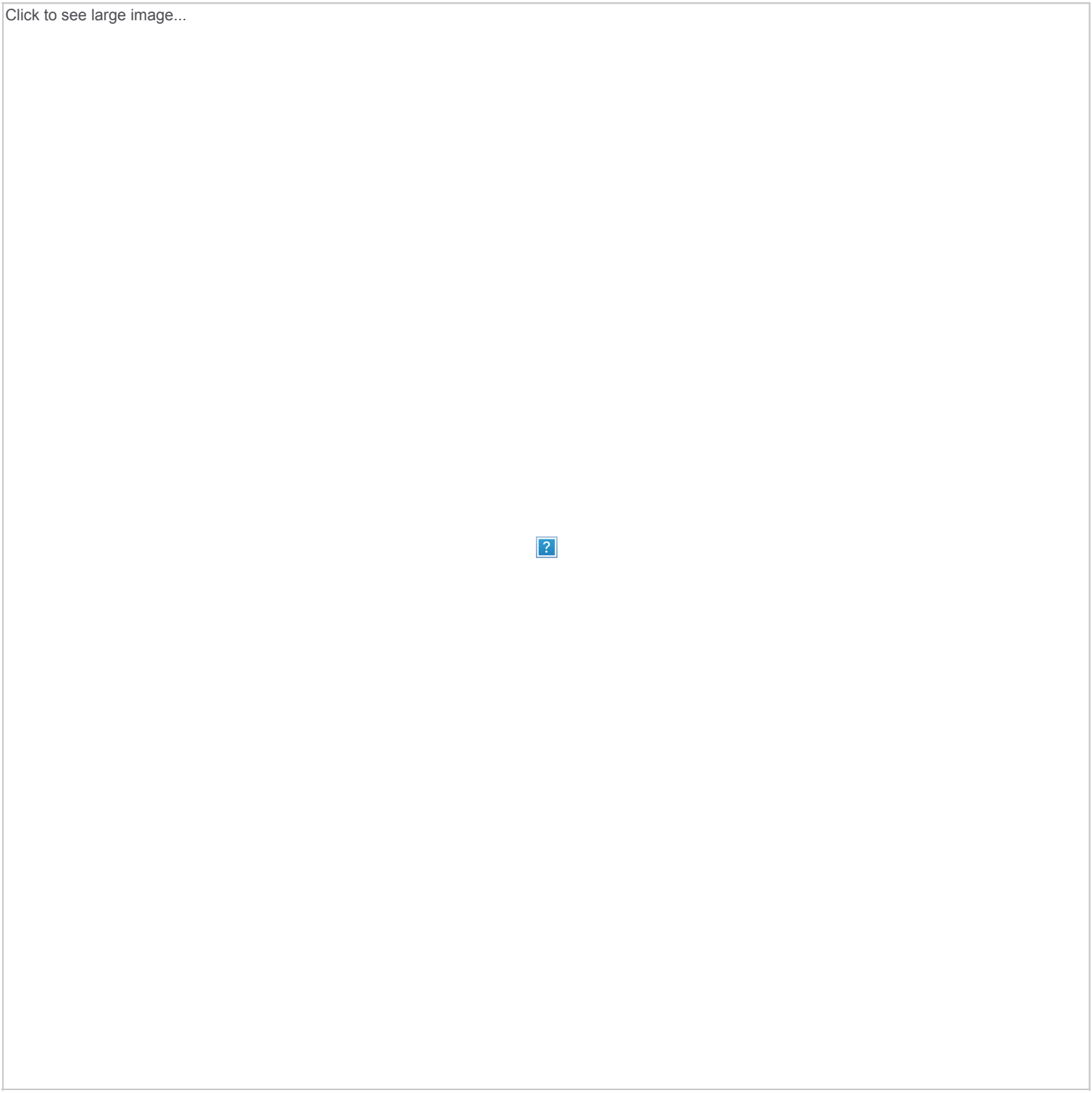
Click to see large image...

- Inspection

Rheostat Switch

1. Disconnect the negative (-) battery terminal.
2. Remove the crash pad lower panel.
   (Refer to Body - "Crash Pad Lower Panel")
3. Remove the left side air vent duct.

Click to see large image...



4. Remove the switch assembly after loosening mounting screws.

Click to see large image...

5. Remove the rheostat switch connector.

Click to see large image...

6. Check for intensity of new rheostat switch. If the light intensity of the lamps changes smoothly without any flickering when the rheostat is turned, it can be assumed that the rheostat is normal.

Click to see large image...

- Removal

1. Disconnect the negative (-) battery terminal.
2. Remove the license lamp lens from the panel after loosening a screw.

Click to see large image...

3. Replace the bulb (B) after removing the license lamp (A).

Click to see large image...

Click to see large image...

- Installation

1. Install the bulb.
2. Install the license lamp lens.

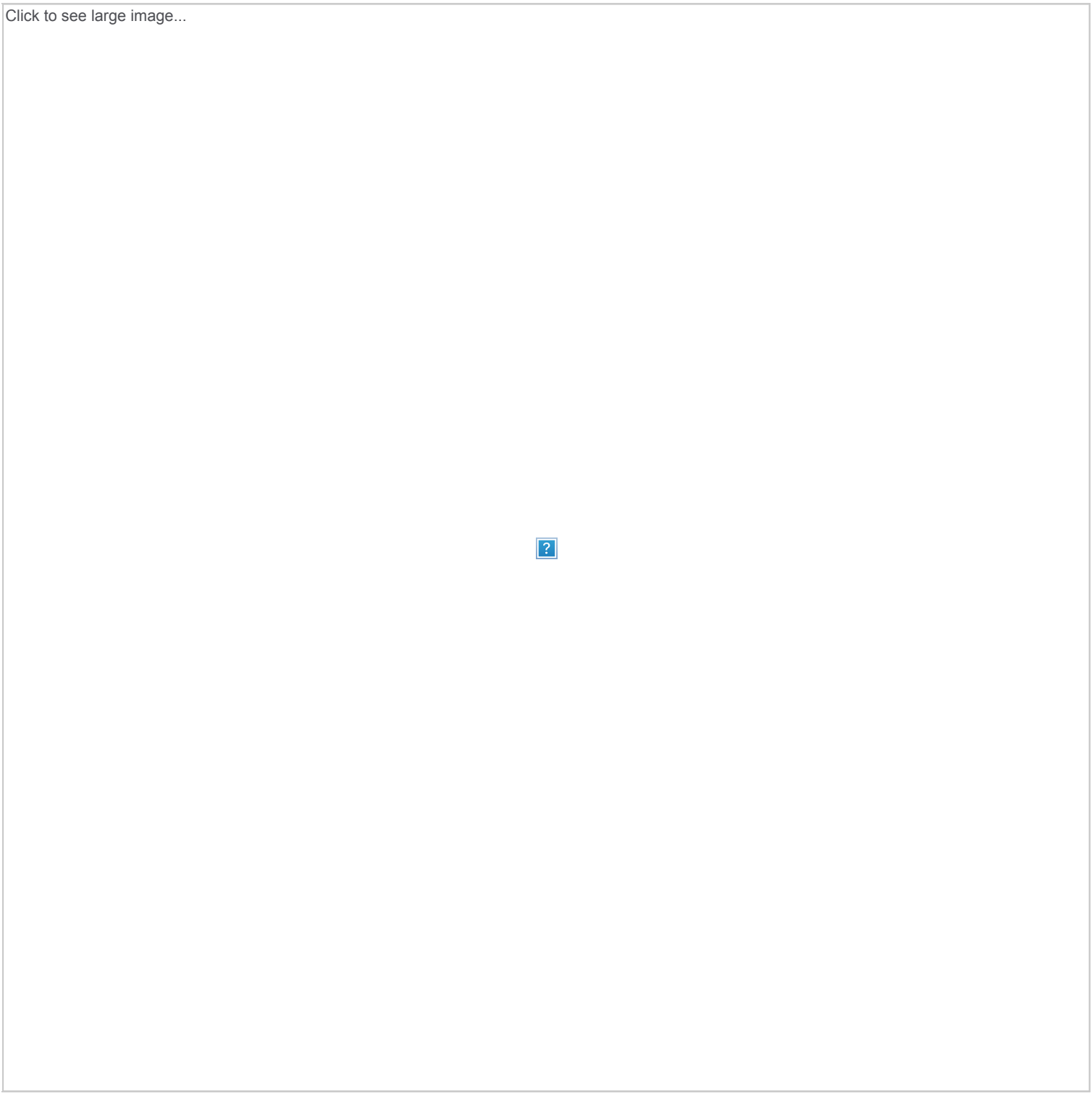
- Removal

High Mounted Stop Lamp

1. Disconnect the negative (-) battery terminal.

2. Remove the rear spoiler.
   (Refer to Body - "Body Side Molding" - "Rear Spoiler")
3. Remove the high mounted stop lamp cover (A).

Click to see large image...



4. Remove the high mounted stop lamp assembly (A) after loosening screws (4EA).

Click to see large image...

- Installation

1. Install the high mounted stop lamp.
2. Install the rear spoiler.
3. Connect the negative (-) battery terminal.

- Removal

1. Disconnect the negative (-) battery terminal.
2. Remove the luggage room lamp lens with a flat-tip screwdriver.

Click to see large image...

3. Remove the luggage room lamp bulb.

Click to see large image...

4. Remove the luggage room lamp assembly after disconnecting the connector (A).

Click to see large image...

- Installation

1. Install the luggage room lamp assembly after connecting the lamp connector.

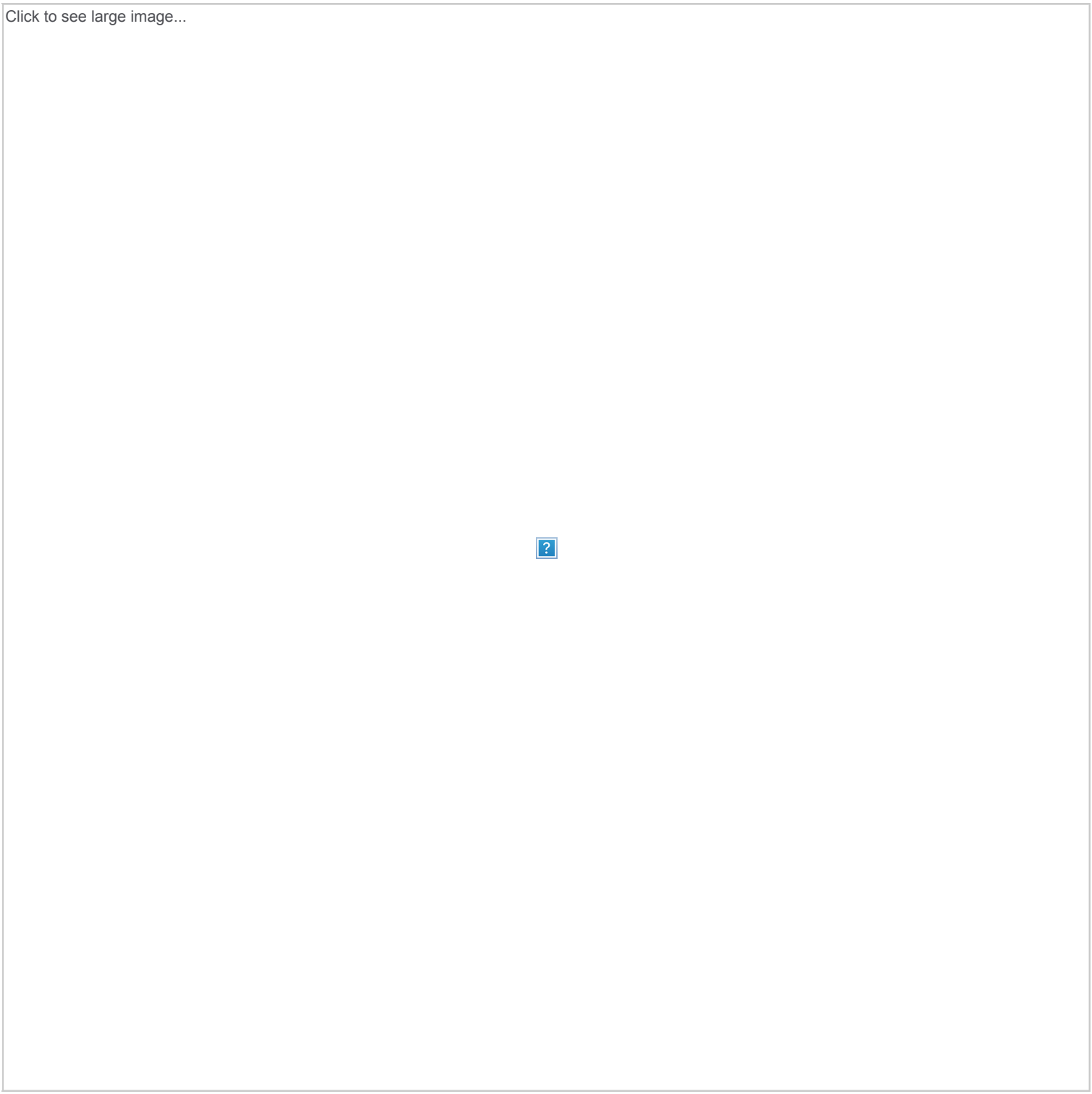
- Removal

1. Disconnect the negative (-) battery terminal.
2. Remove the rear combination lamp cover (A) with a flat-tip screwdriver.
3. Remove the rear combination lamp mounting cap (A).

Click to see large image...

4. Loosen the mounting bolts then remove the outside rear combination lamp (A).

Click to see large image...



5. Disconnect the rear combination lamp connector (A).

Click to see large image...

- Installation

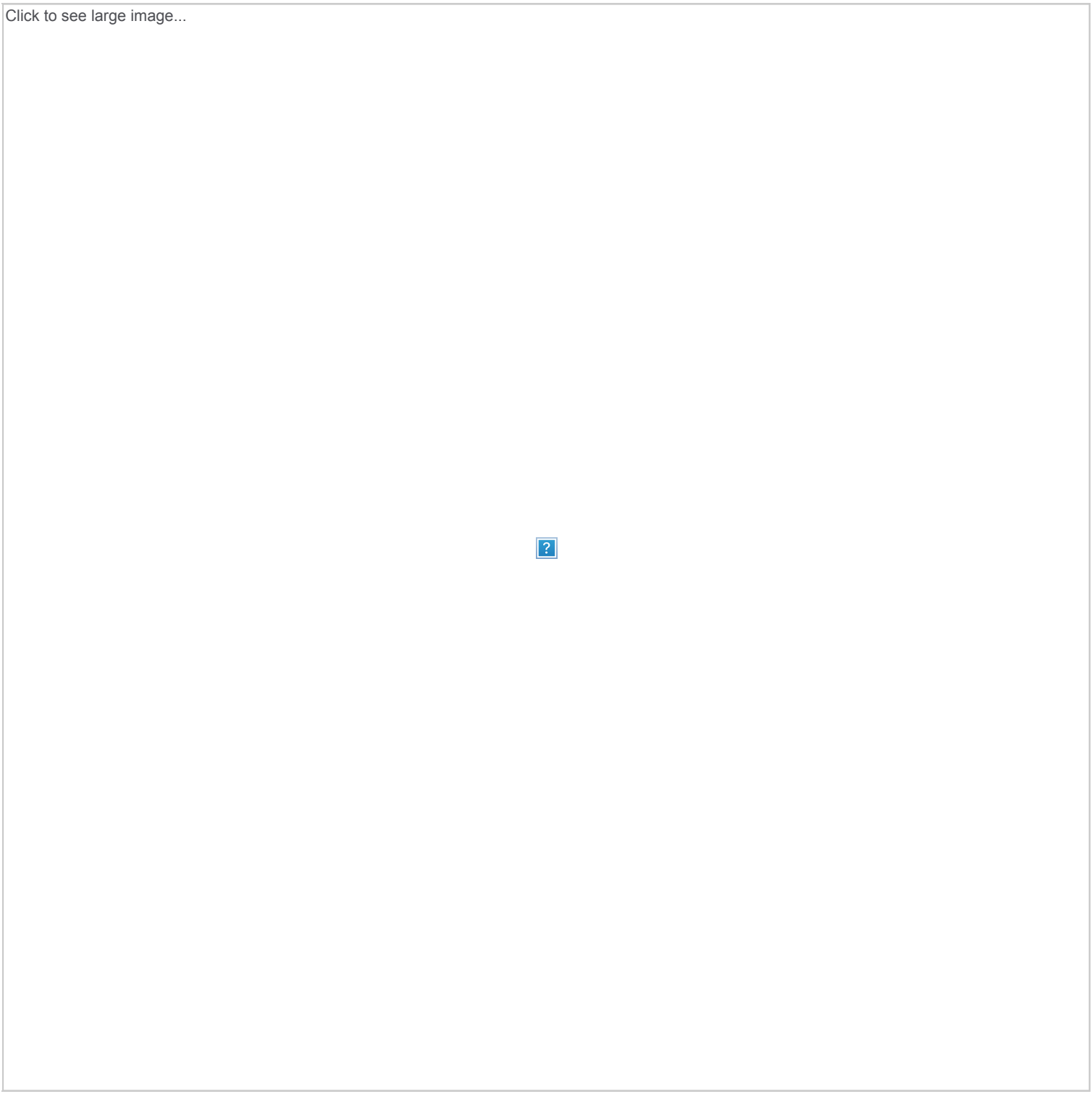
1. Install the rear combination lamp
2. Connect the negative (-) battery terminal.

- Removal

1. Disconnect the negative (-) battery terminal.
2. Remove the rear bumper.
   (Refer to Body - "Rear Bumper Cover")

3. Remove the back up lamp (A) after loosening mounting screws.

Click to see large image...



- Installation

1. Install the back up lamp.
2. Connect the back up lamp connector.
3. Install the rear bumper cover.
4. Connect the negative (-) battery terminal.

- Troubleshooting

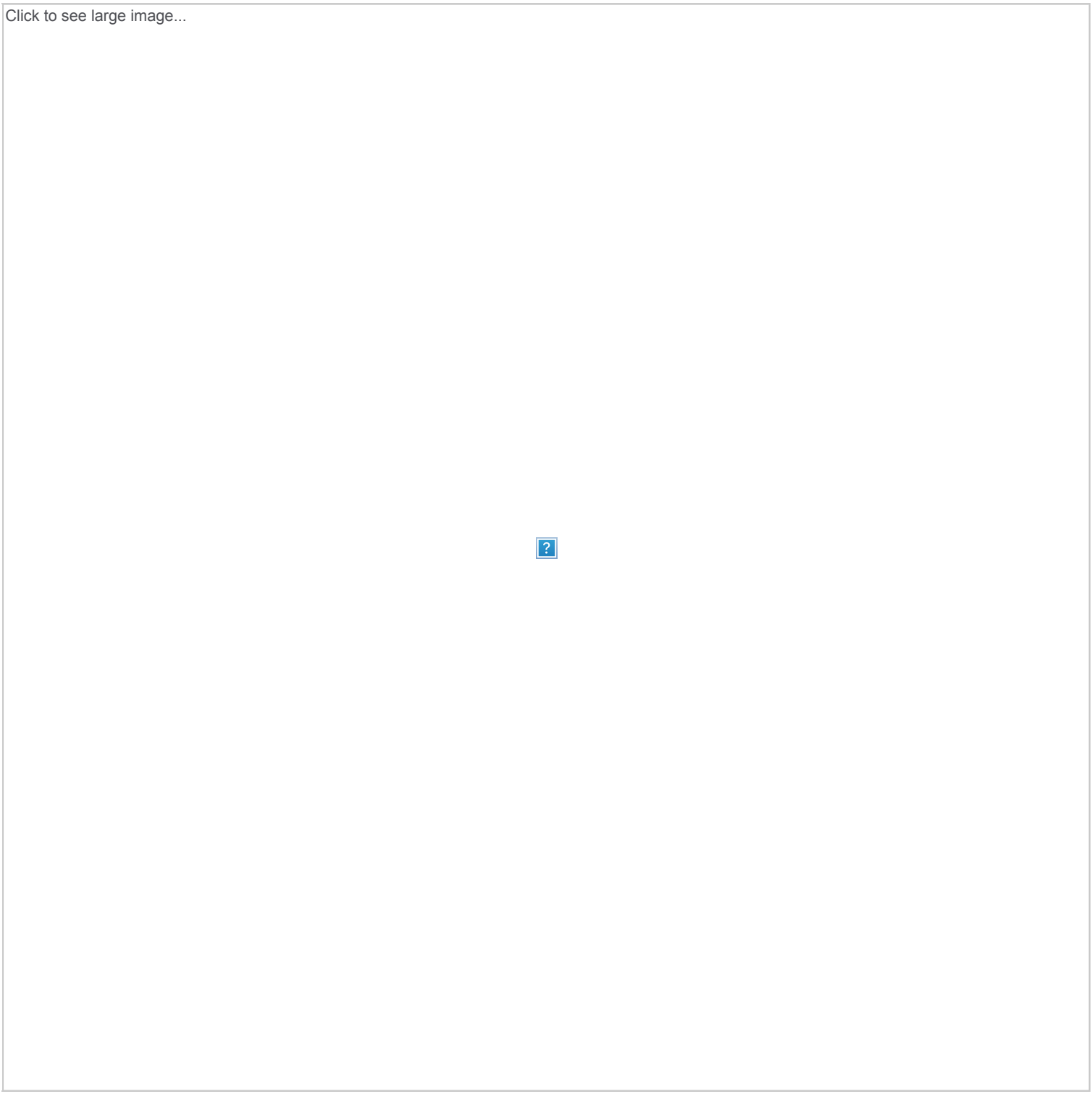
Symptom	Possible cause	Remedy
One lamp does not light (all exterior)	Bulb burned out	Replace bulb
	Socket, wiring or ground faulty	Repair if necessary
Head lamps do not light	Bulb burned out	Replace bulb
	Ignition fuse (LOW:10A, HIGH:20A) blown	Check for short and replace fuse
	Head lamp fuse (15A) blown	Check for short and replace fuse
	Head lamp relay faulty	Check relay
	Lighting switch faulty	Check switch
	Wiring or ground faulty	Repair if necessary
Tail lamps and license plate lamps do not light	Bulb burned out	Replace bulb
	Tail lamp fuse (10A) blown	Check for short and replace fuse
	Tail lamp relay faulty	Check relay
	Lighting switch faulty	Check switch
	Wiring or ground faulty	Repair if necessary
Stop lamps do not light	Bulb burned out	Replace bulb
	Stop lamp fuse (15A) blown	Check for short and replace fuse
	Stop lamp switch faulty	Adjust or replace switch
	Wiring or ground faulty	Repair if necessary
Stop lamps do not turn off	Stop lamp switch faulty	Repair or replace switch
Instrument lamps do not light (Tail lamps light)	Rheostat faulty	Check rheostat
	Wiring or ground faulty	Repair if necessary
Turn signal lamp does not flash on one side	Bulb burned out	Replace bulb
	Turn signal switch faulty	Check switch
	Wiring or ground faulty	Repair if necessary
Turn signal lamps do not light	Bulb burned out	Replace bulb
	Turn signal lamp fuse (10A) blown	Check for short and replace fuse
	Flasher unit faulty	Check flasher unit
	Turn signal switch faulty	Check switch
	Wiring or ground faulty	Repair if necessary
Hazard warning lamps do not light	Bulb burned out	Replace bulb
	Hazard warning lamp fuse (15A) blown	Check for short and replace fuse
	Flasher unit faulty	Check flasher unit
	Hazard switch faulty	Check switch
	Wiring or ground faulty	Repair if necessary
Flasher rate too slow or too fast	Lamps' wattages are smaller or larger than specified	Replace lamps
	Flasher unit faulty	Check flasher unit
Back up lamps do not light	Bulb burned out	Replace bulb
	Back up lamp fuse (10A) blown	Check for short and replace fuse
	Back up lamp switch (M/T) faulty	Check switch
	Transaxle range switch (A/T) faulty	Check switch
	Wiring or ground faulty	Repair if necessary
Room lamp does not light	Bulb burned out	Replace bulb
	Room lamp fuse (10A) blown	Check for short and replace fuse
	Room lamp switch faulty	Check switch
	Wiring or ground faulty	Repair if necessary
Front fog lamps do not light	Bulb burned out	Replace bulb
	Front fog lamp fuse (15A) blown	Check for short and replace fuse
	Front fog lamp relay faulty	Check relay
	Front fog lamp switch faulty	Check switch
	Wiring or ground faulty	Repair if necessary
Wiring or ground faulty	Repair if necessary	
Map lamp does not light	Bulb burned out	Replace bulb
	Room lamp fuse (10A) blown	Check for short and replace fuse
	Map lamp switch faulty	Check switch

	Wiring or ground faulty	Repair if necessary
Trunk room lamp does not light	Bulb burned out	Replace bulb
	Room lamp fuse (10A) blown	Check for short and replace fuse
	Trunk room lamp switch faulty	Check switch
	Wiring or ground faulty	Repair if necessary

- Removal

1. Disconnect the negative (-) battery terminal.
2. Remove the front bumper.
   (Refer tor Body - "Front Bumper")
3. Disconnect the DRL connector (A).

Click to see large image...



4. Remove the DRL from the vehicle.

Click to see large image...

- Installation

1. Install the DRL.
2. Install the front bumper.
3. Connect the negative (-) battery terminal.

- Specifications

Items	Specifications
Rated voltage	DC +5V

Load		Max. 1mA (When head lamp lighting)	
Auto light sensor	Illuminations (Lux)	100	0.76 ± 0.17V
		150	1.3 ± 0.30V
Photo sensor (Single)	Illuminations (Lux)	100	0.56 ± 15%V
		150	0.86 ± 15%V
Photo sensor (Dual)	Illuminations (Lux)	100	0.28 ± 15%V
		150	0.43 ± 15%V

- Component Location

Click to see large image...

1. Auto light sensor
2. Head lamps
3. Lighting switch (Auto)
4. Tail lamps
5. IBU (Integrated Body Control Unit)

- Circuit Diagram

Click to see large image...

- Description

It's a system that uses illumination sensor to automatically turn ON the tail lamp and head lamp based on the change in surrounding environment's illumination condition. It activates when the vehicle enters/exits tunnel, or when the illumination condition in surrounding environment changes due to rain, snow, or fog. Precautions corresponding to the use of this system are as follows.

1. Do not add another device on top of this device.
2. Be sure to switch to manual during poor visibility climate, such as fog, heavy rain, or cloudy weather.
3. Illumination intensity in an actual vehicle is not always constant, and lamp ON/OFF time may very depending on the climate, season, and surrounding environment.

4. Use this system only during sunrise and sunset period, and manually control lamp ON/OFF for general conditions.
5. Error may occur if light block coating that may change interior illumination is applied.

- Inspection

Check if the auto light control operates like a timing chart shown below. Tail lamp output and head lamp (Low) output is controlled based on the auto light sensor's input (illumination intensity) when the Auto Light Switch in Multi-Function Switch is turned ON, and the vehicle is in IGN1 or IGN2 ON Mode. If IGN1 = ON, BCM detects this voltage, and if the voltage exceeds rated voltage, then auto light failure occurs. (below 4V or above 6V)

NOTICE

- Failure Occurrence : If auto light failure occurs, the head lamp must be turned ON regardless of sun light level. This is to prevent the head lamp from being turned OFF in case of auto light failure during night time.

In the state of IGN1 ON, when multi function switch module detects auto light switch on, tail lamp relay output and head lamp low relay output are controlled according to auto light sensor's input.The auto light control doesn't work if the pin sunlight supply (5V regulated power from Ignition 1 power to sunlight sensor) is in short circuit with the ground.If IGN1 ON, The BCM monitors the range of this supply and raises up a failure as soon as the supply’s voltage is out of range. Then this failure occurs and as long as this is present, the head lamp must be turned on without taking care about the sunlight level provided by the sensor.This is designed to prevent any head lamp cut off when the failure occurs during the night.

Click to see large image...

Click to see large image...

Click to see large image...

- Removal

1. Disconnect the negative (-) battery terminal.
2. Remove the photo & auto light sensor (A) from crash pad upper side by using a flat-tip screwdriver.

Click to see large image...

3. Remove the auto light connector.

- Installation

1. Reconnect the auto light connector.
2. Install the auto light sensor.

- Components Location

Click to see large image...

1. Head Up Display (HUD)
2. Rain(Light) sensor
3. Cluster (User setting menu On/Off)

- Description

1. System operation

Click to see large image...

HUD system displays various information on the windshield glass which minimizes the driver’s eye movement to enhance safety and convenience.
The Head Up Display reflects the TFT LCD images to two mirrors (flat/concave) and displays them 2.32m ahead from the driver's eye.
Information provided by HUD :

(1) Vehicle speed

(2) Integrated (DIS) information TBT (Turn by Turn) navigation information, road signage

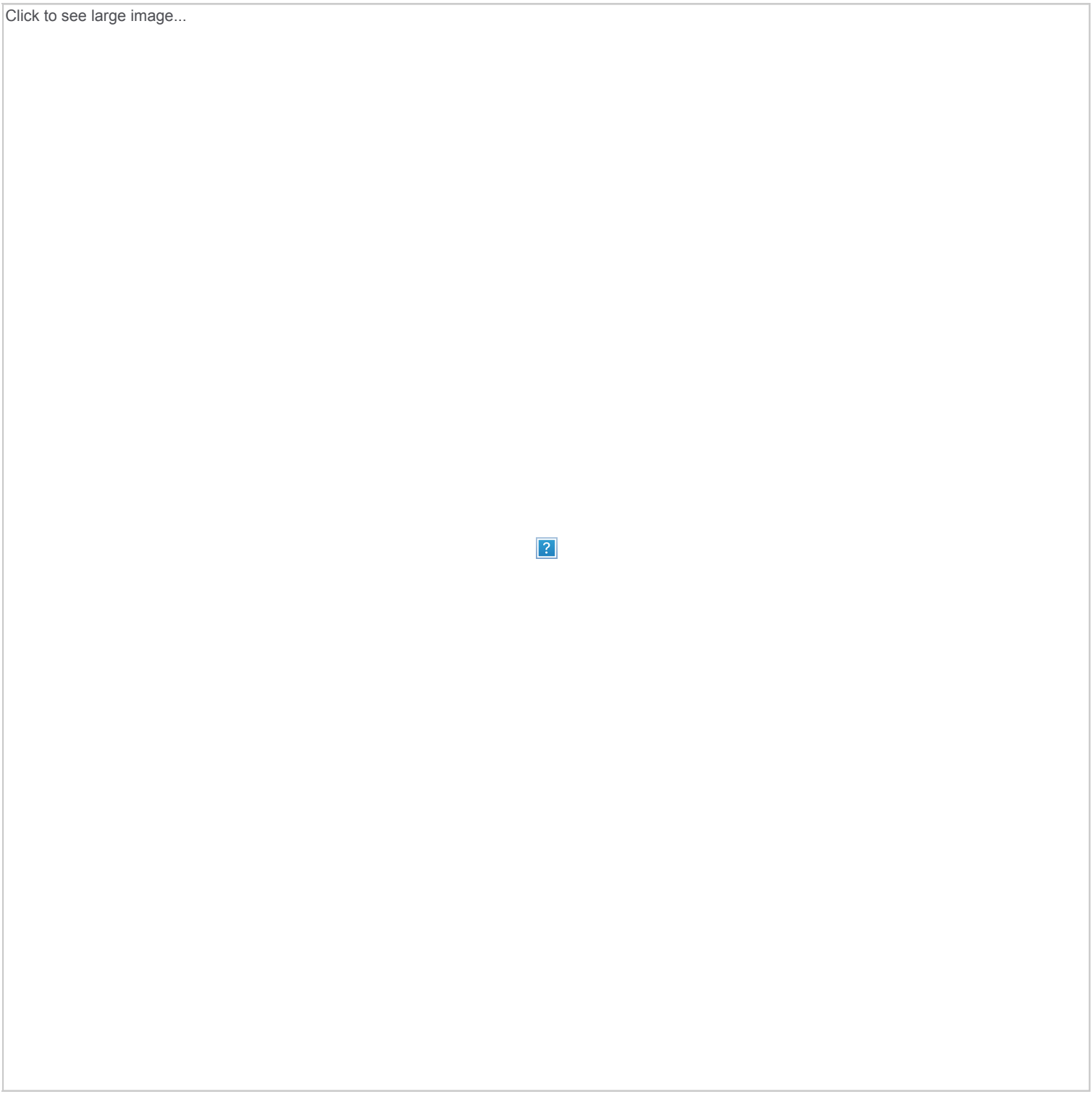
(3) Safety warning lamp: SCC, LKAS, LFW, Blind Spot Warning

2. HUD Display Contents

Click to see large image...

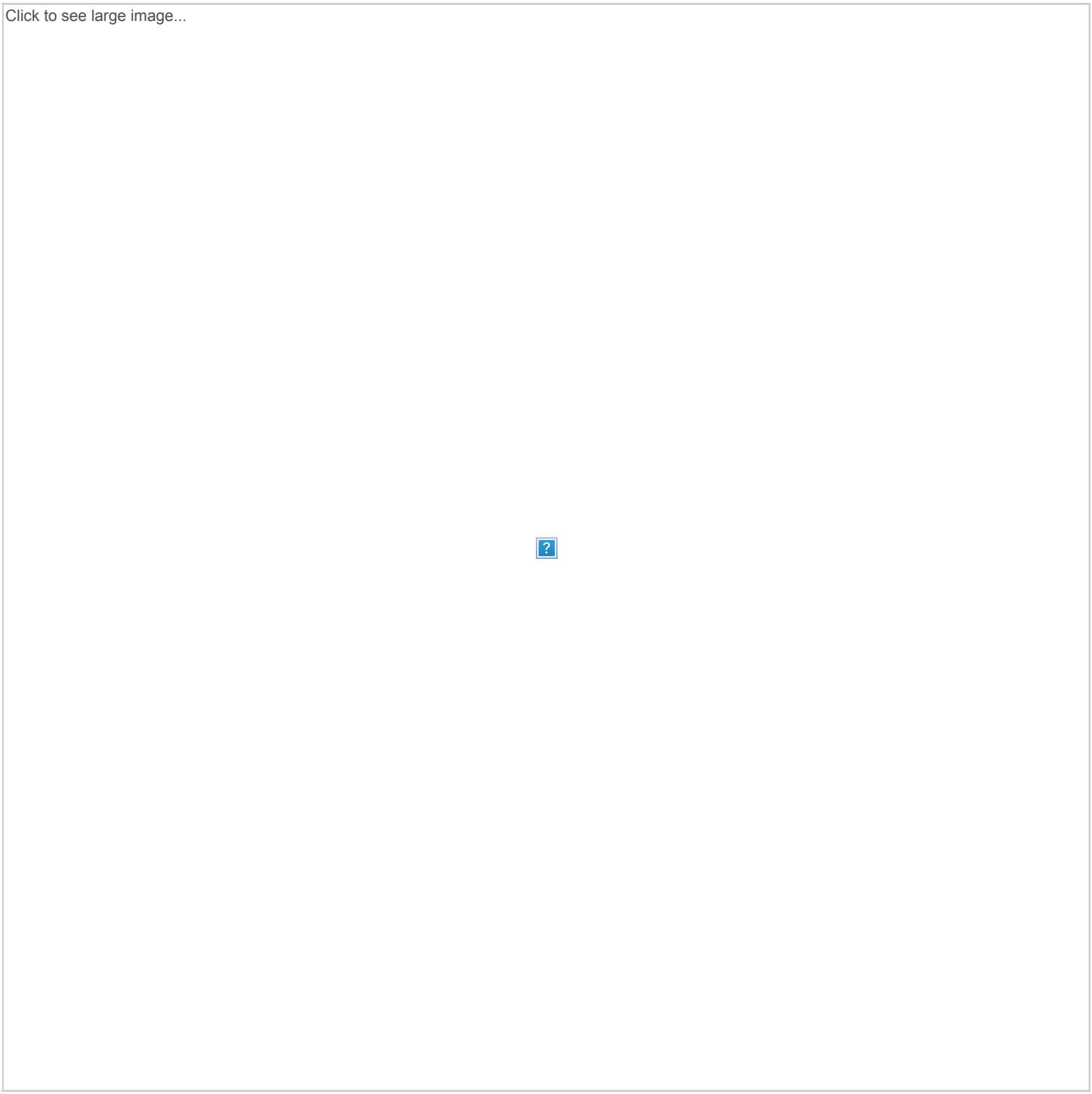
3. HUD Unit
   Head Up Display : Information of the vehicle system is output to the combine through CAN communication.

Click to see large image...



4. Cluster

Click to see large image...



5. Ambient Light Sensor

   Ambient light sensor: The two-direction (horizontal, vertical) measuring sensor is applied and the HUD brightness is adjusted by the horizontal measurements.

   – Two-direction measuring ambient light sensor applied

Click to see large image...

⚠ CAUTION

If the ambient light sensor measurement is not recognized, the HUD does not work. Make sure that the sensor should work before checking the HUD.

- Component

Click to see large image...

- Removal

1. Disconnect the negative (-) battery terminal.
2. Remove the instrument cluster.
   (Refer to Indicators And Guages - "Instrument Cluster")
3. Remove the head up display upper cover (A).

Click to see large image...

4. Remove the head up display bracket (A) after loosening nuts and screws.

Click to see large image...

5. Remove the head up display unit (A) and then remove the head up display unit after loosening the mounting screws.

Click to see large image...

- Installation

1. Install the head up display unit.
2. Install the instrument cluster.
3. Connect the negative (-) battery terminal.

- Inspection

If a part of the headup display footage is distorted or it is not at eye level with the driver a Global Diagnostic System (Diagnostic tool) can be used to carry out calibration.

1. In case calibration is required
   –

When replacing the head-up display unit.

– In case the footage is distorted after replacing the windshield (double vision removed after film is inner mounted to the glass).
– When the HUD mounted main crashpad is removed/installed or replaced.
– When the video installation location of the Head-up display unit is not at eye level of the driver and the focus is inconsistent.

2. calibration items

No	Footage calibration functions	Calibration cases
1	Rotation : Calibration in the half-circle/clockwise direction based on the center	Click to see large image...
2	Smile : Calibration based vertically on the center	Click to see large image...

3	Slanted(up/down) : Calibration according to an upward/downward slant	Click to see large image...
4	Slanted(left/right) : Calibration according to a left/right slant	Click to see large image...

5	Parallel compensation	Click to see large image...
6	Move location of mark to upward/downward : Compensation according to eye height	Click to see large image...
7	Initialization : Changed to the status of before video compensation	

8	Widt	Click to see large image...
9	Height	Click to see large image...

- Troubleshooting

Category	Error symptoms	inspection item	Detailed inspection item	Related parts
Lighting	• HUD not working • Lighting brightness not automatically controlled (no difference between day and night)	• Check the lighting control • Check the ambient light sensor operation • Check the CAN communication	• Check the lighting control in the cluster USM → If working, HUD has no problem. • Check the ambient light sensor operation → If the ambient light sensor works, check the communications (CGW ↔ HUD)	Light sensor CGW Cluster
	•	•	• If the step motor does not work when IG is on or off,	HUD

Adjustment function	Display position not adjusted	Check the mirror movement when IG is on or off (parking position)	→ The step motor in HUD fails. • If the step motor in HUD works when IG is on or off, → Check the CAN communications (cluster ↔ HUD)	Cluster

- Specification

Item		Specification
Ultrasonic sensor	Voltage rating	DC 12 V
	Detecting range	40cm - 120cm
	Operation voltage	DC 9 - 16 V
	Operation current	MAX 300 mA
	Operation temperature	-30°C to +80°C (-22°C to- +176°C)
	Operation frequency	48 ± 5 KHz
	Number of sensors	8 (Left side, Left center, Right center, Right side)

※ Parking Distance Warning function is built in IBU (Integrated Body Control Unit).

- Component Location

Click to see large image...

1. IBU (Integrated Body Control Unit)
2. Parking distance warning sensor

※ Parking Distance Warning function is built in IBU (Integrated Body Control Unit).

- System Configuration

PDW consists of 8 sensors (Front 4 EA, Rear 4EA) which are detecting the obstacles and transmit the result separated into three warning levels, the first, second and third to IPM (IBU) by Lin communication. IPM(IBU) decides the alarm level by the transmitted communication message from the slave sensors, then operate the buzzer or transmits the data for display.

Block Diagram

Click to see large image...

System Operation Specification

1. Initial mode - Front sensor
   (1) System initializing time is 500ms after IGN1+ initial D Gear + below 10 Km/h .
   (2) PDW recognizes LID and sets the sensor ID up during initialization.
   (3) PDW activates each sensor and then executes the diagnosis after finishing initialization of IPM(IBU).
   (4) PDW Starting buzzer” is normally worked, when sensor does not send an error message and after finishing error diagnosis.

(5) If any failure is received from the any sensors, PDW Starting Buzzer” does not work but the failure alarm is operated for a moment.
If you have display option, warning sign is also shown on it.

(6) Buzzer for sensor failure is operated once, but display is shown continuously until it is repaired completely.

(7) IPM(IBU) memorizes the completed initializing status of front sensor until IGN 1 is OFF. It doesn't activate initializing when next D gear input.

(8) In case of PDW SW OFF, system initializing does not be activated.

(9) If PDW switch is ON like as below status, it activates initializing.
- – PDW switch OFF when IGN1 is On.
- – PDW switch ON when vehicle speed is below 10 km/h

(10) Initializing has nothing to do with parking brake operation.

2. Initial mode - Rear sensor

(1) System initializing time is 500ms after IGN1+ initial R Gear.

(2) PDW recognizes LID and sets the sensor ID up during initialization.

(3) PDW activates each sensor and then executes the diagnosis after finishing initialization of IPM(IBU).

(4) PDW Starting buzzer” is normally worked, when sensor does not send an error message and after finishing error diagnosis.

(5) If any failure is received from the any sensors, PDW Starting Buzzer” does not work but the failure alarm is operated for a moment.
If you have display option, warning sign is also shown on it.

(6) Buzzer for sensor failure is operated once, but display is shown continuously until it is repaired completely.

(7) IPM(IBU) memorizes the completed initializing status of rear sensor until IGN 1 is OFF. It doesn't activate initializing when next R gear input.

(8) Initializing has nothing to do with parking brake operation.

3. Normal mode - Front sensor

(1) Lin communication starts and keeps the routine after IGN1 ON+D gear + below 10 km/h.

(2) After initializing, the routine starts at once without PDW starting warning sound.

(3) Alarms of obstacle consists of 3 level 1,2,3 step and 1,2 alarm sounds intermittently and 3 alarm sounds continuously. 1 level alarm doesn't exist in the front ultrasonic sensor.
- – Type with display
  - • 2 level alarm : Display is only operated without alarm.
  - • 3 level alarm : Alarm + Display
- – Type without display : Alarm only

(4) In display, the data of each sensor is sent from IPM(IBU) to display, for example cluster. CAN communication is used for transmission and maximum gateway time is 50ms.

(5) The efficient vehicle speed of RPDW operation is under 10Km/h.

(6) It doesn't work at PDW SW OFF.

(7) It has nothing to do with parking brake operation.

(8) Operation doesn't start or stops at gear N, P.

4. Normal mode - Rear sensor

(1) Lin communication starts and keeps the routine after IGN1 ON+R gear

(2) IBU send a message once to each sensor for operating request to check the initial status of the system and four sensors response at a time. At this time, if there is no problem, the alarm starts after 500ms of R gear shifting at 300ms intervals.

(3) After initialization, normal mode starts 100ms later after finishing alarm output.

(4) Alarm for obstacles is divided into 3 levels.
The first and second are intermittent sound, and the third alarms continuously

(5) In display, the data of each sensor is sent from IBU to display, for example Cluster.
CAN communication is used for transmission and maximum gateway time is 50ms.

(6) It has nothing to do with vehicle speed.

(7) When PDW SW is OFF, if gear R signal is inputted, PDW SW is changed to ON.

(8) It has nothing to do with parking brake operation.

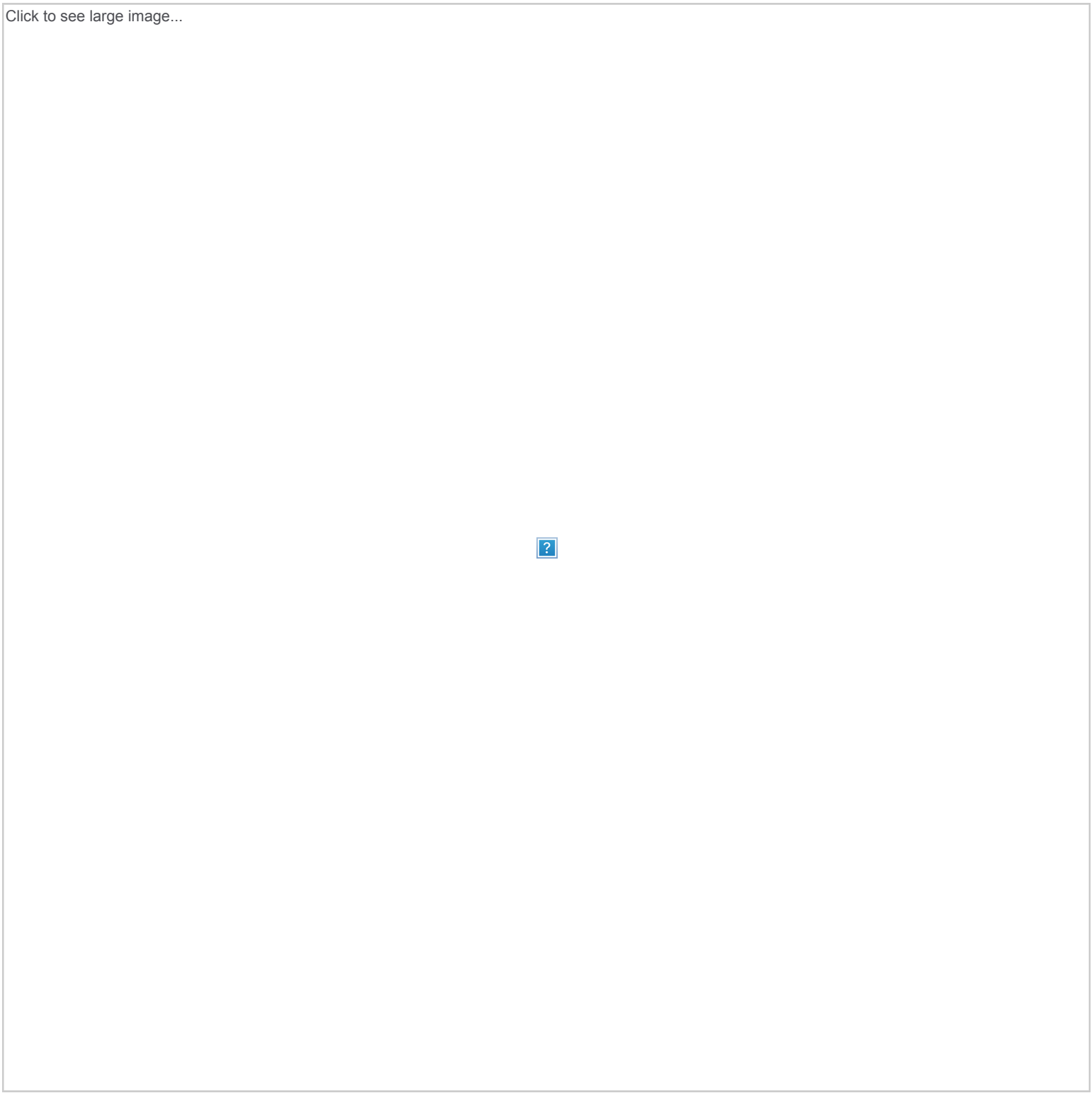
(9) Operation doesn't start or stops at gear N, P.

Sensing Area

1. Measurement condition – PVC pole (diameter 75 mm, length 3 m), normal temperature
2. Distance range detected objects (Measured directly in front of sensor)
   - Front sensor
     61 cm (24 in) - 10 cm (39.4 in) : ±15 cm (5.9 in)
     31 cm (12.2 in) - 60 cm (23.6 in): ±15 cm (5.9 in)
     Less than 20 cm (7.9 in) : ± 10 cm (3.9 in)
   - Rear sensor
     61 cm (24.0 in) - 120 cm (47.2 in) : ± 15 cm (5.9 in)
     31 cm (12.2 in) - 60 cm (23.6 in): ± 15 cm (5.9 in)
     Less than 30 cm (11.8 in) : ± 10 cm (3.9 in)

Horizontal Sensing Area

Click to see large image...



Vertical Sensing Area

Click to see large image...

Distance Measurement

Direct Measurement

Transmission and Reception are executed with one sensor
(FL, FCL, FCR, FR, RL, RCL, RCR, RR each sensor execution)

Click to see large image...

Indirect Measurement

(FCL → FL, FCL → FCR, FCR → FCL, FCR → FR, RCL → RL, RCL → RCR, RCR → RCL, RCR → RR Execution in order)

With two or three sensors, one of them sends the transmission and the others get the reception.

Click to see large image...

Direct and Indirect Measurement at once

With two or three sensors, the one sensor performs both transmission and reception, and the others perform only reception.

Click to see large image...

PDW-R alarm system

When the PDW-R sensor detects the object, warning is operated by audible alarm device as like buzzer. PDW-R sensor sends data to IBU with LIN communication and IBU implements audible warning for each RPDW SENSOR by priority. And it performs a role of gateway only when it sends visible alarm device such as Cluster.

– Sensor buzzer/display information processing method of IBU In case of RL/RR sensor information, the IBU handles each sensor information directly about Display and buzzer output function. Buzzer output of CL/CR sensor, IBU handles center combination information by priority both sensor, Otherwise, about fail display information,IBU send that to cluster each sensor information.

System operation Spec - Front sensor

When the system has the power (after IGN ON and D gear), MICOM checks every sensor channel. In case it is not find any error, it sounds 500ms afterward. But it finds any error even a sensor, it sounds buzzer corresponding fault sensor instead of initial starting alarm. If PDW ON switch in OFF, system doesn't work. Function for normal mode entrance is as below.

Click to see large image...

* In the initial mode, IPM (IBU) judges only sensor fail.

With D gear, system function is as below.

Click to see large image...

With D gear releasing, system function is as below

Click to see large image...

System Operation Spec - Rear sensor

When the system has the power (after IGN ON and R gear), MICOM checks every sensor channel.In case it is not find any error, it sounds 300ms buzzer 500ms afterward.But it finds any error even a sensor, it sounds buzzer corresponding fault sensor instead of initial starting alarm. Function for normal mode entrance is as below

Click to see large image...

With R Gear, system function is as below

Click to see large image...

With R gear releasing, system function is as below

Click to see large image...

※acceptable error range on waveform ±10%

Alarm Output Specification classified by distance between sensors

Condition logic according to priority of alarm level is as below. (the identical sensor)

Click to see large image...

*α value definition

1. low priority sensor off : α = 0ms
2. low priority sensor is 1st warning level : α < 340ms
3. low priority sensor is 2nd warning level : α < 170ms

*β value definition

1. low priority sensor is 1st warning level : β = 1700ms
2. low priority sensor is 2nd warning level : β = 1700ms
3. low priority sensor is 3rd warning level : β = 700ms

Alarm control by sensing distance is as below

1. First warning area (Front: 61 cm (24 in) - 100 cm (39.4 in), Rear: 61 cm (24 in) - 120 cm (47.2 in))

Click to see large image...

2. Second warning area (Front/Rear: 31 cm (12.2 in) - 60 cm (23.6 in))

Click to see large image...

3. Third warning area (Front/Rear: less than 30 cm (12.2 in))

Click to see large image...

4. Alarm fo ultrasonic sensor

   If one or more front/rear paking assistance sensor have any fault, alarm will sound and warning message will be displayed (cluster).

   1) Alarm sound

Click to see large image...

2) Alarm message

Click to see large image...

NOTICE

Displayed image and warning message may vary depending on the vehicle model.

Visible Alarm Indicator Specification

1. Alarm level per distance - Front, Rear sensor

   When the gear is applied to R, cluster lights the indicator as below figure.When the system finds an object, it lights indicator immediately. During sensing an object, if there is no object, it lights indicator that is no alarm status for two seconds and then turns out afterward detecting an object. (But when it turns third step alarm to No alarm status, it lights third step alarm for two second and turns out.)

Click to see large image...

* It only displays the position of detected obstacle.
* Indicator flickers every 1 second at third step alarm.
* Integrated display (FCL/FCR, RCL/RCR).

- Inspection

Inspection

If a problem occurs with the ultrasonic sensor, check the following items.

1. Perform basic inspection as below.
   (1) Check battery terminals and state of charge.

(2) Check fuses and relays.

(3) Check the connection status of the connector.

(4) Check wiring and connectors for damage.

2. Check for the cleanliness of the bumper.
   - Performance may decline if snow or water is frozen on the sensor surface.
   - Performance may decline if foreign substance such as mud is on the sensor surface.
3. Check for the condition of the bumper and its surrounding.
   - Performance may decline if any object emitting ultrasonic is nearby.
   - Performance may decline if object is attached near ultrasonic sensor.
4. Check for the shape and the installation of the bumper.
   - Performance may decline if the ultrasonic sensor or surrounding parts are dismantled.
   - Performance may decline if sensor membrane is damaged (stone chip) or if sensor body is damaged due to modifications or during maintenance. Check both parts for damage.
   - Performance may decline if the mounting condition of the ultrasonic sensor has been changed since the first delivery of the vehicle.
   - Performance may decline if the number plate is installed somewhere other than the standard location.
5. Check for the mounting condition of the ultrasonic sensor if the DTC occurs.
6. Check for the button if it is operational.
   - For PCA specification, press and hold (over a second) the parking safety button (①) to check PCA on/off.
   - For PDW specification, briefly press (less than a second) the parking safety button (①) to check PDW on/off.

Click to see large image...

Diagnosis with Diagnostic tool

1. In the ultrasonic sensor, failure can be quickly diagnosed by using the vehicle diagnostic tool. (Refer to "DTC guide")
   (1) Self diagnosis : Checking failure and diagnosis troublecode (DTC).
   (Refer to DTC guide when fault code is found.)

Information

- Refer to the diagnostic tool screen for operating conditions and details.

- Component

Click to see large image...

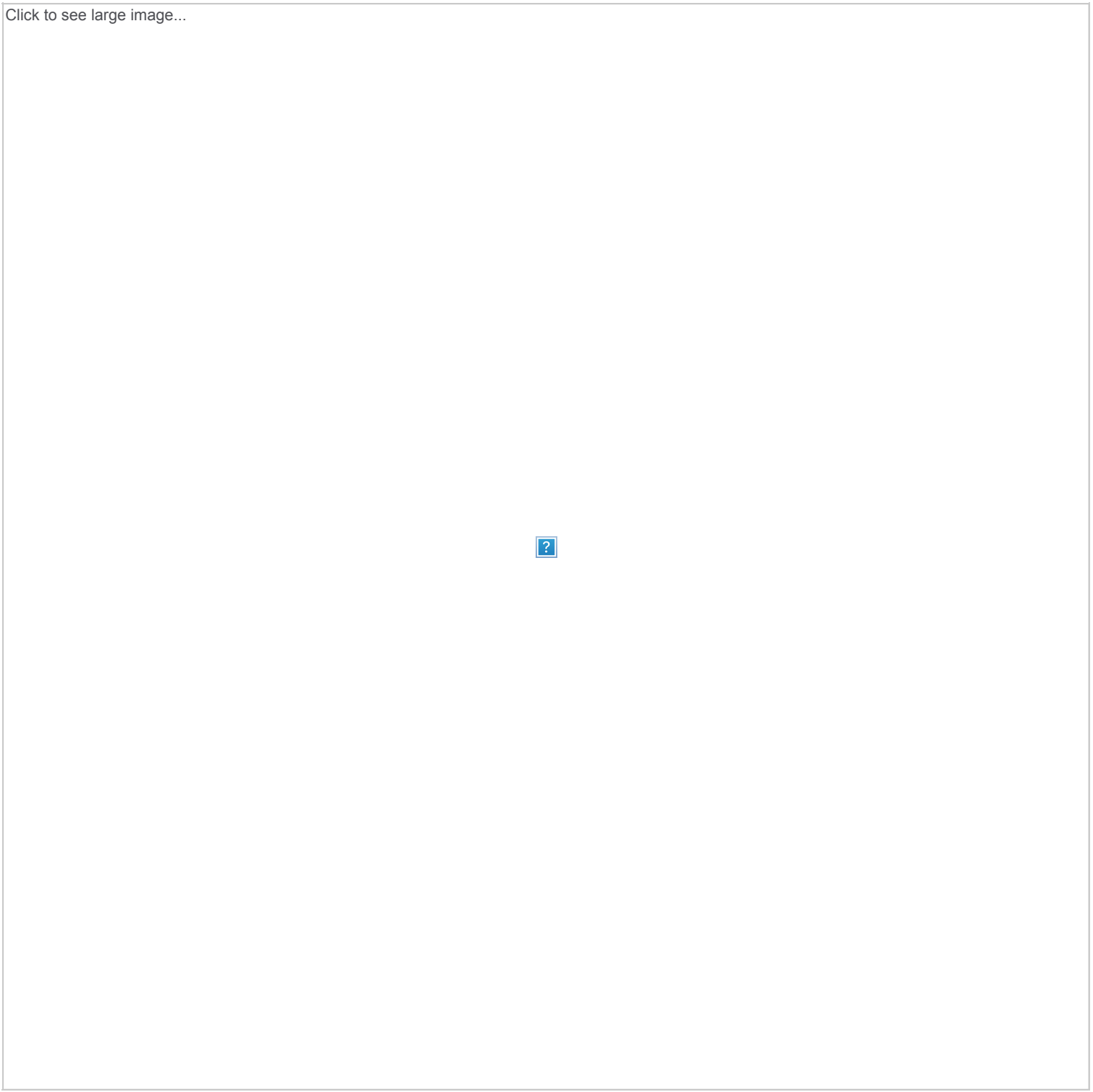
- Removal

1. Disconnect the negative (-) battery terminal.
2. Remove the front/rear bumper.
   (Refer to Body - "Front Bumper Cover")
   (Refer to Body - "Rear Bumper Cover")
3. Disconnect the connector from the parking distance warning sensor.

4. Pull out the sensor (A) by opening the sensor holder out.

[L TYPE]

Click to see large image...



[I Type]

Click to see large image...

- Installation

1. Install the Parking distance warning sensor after connecting the connector.
2. Install the front/rear bumper cover.
3. Connect the negative (-) battery terminal.

- Components

Click to see large image...

1. Rear Occupant Alert Sensor
2. Integrated body control unit
3. Cluster (Message pop-up and Voice)

- Description

The system detects the passenger in the vehicle and prevents the driver from getting off the vehicle with the passenger in the back.

Click to see large image...

- 1st warning: If you open the driver's door after you open and then close the rear passenger and turn the engine off, the system provides warning by showing message on the cluster and giving voice instruction.

- 2nd warning

1) The system detects the indoor movement using the rear occupant alert sensor installed on the head lining when the driver gets off the vehicle and locks all the doors.

2) If any movement inside the vehicle is detected, horn and Hazard Warning Flasher are activated for 25 seconds and the mobile text message is sent.

Click to see large image...

- Removal

1. Disconnect the negative (-) battery terminal.
2. Remove the cover (A) by using a flat-tip screwdriver.

Click to see large image...

3. Disconnect the connector (A) and then remove the occupant alert sensor.

Click to see large image...

- Installation

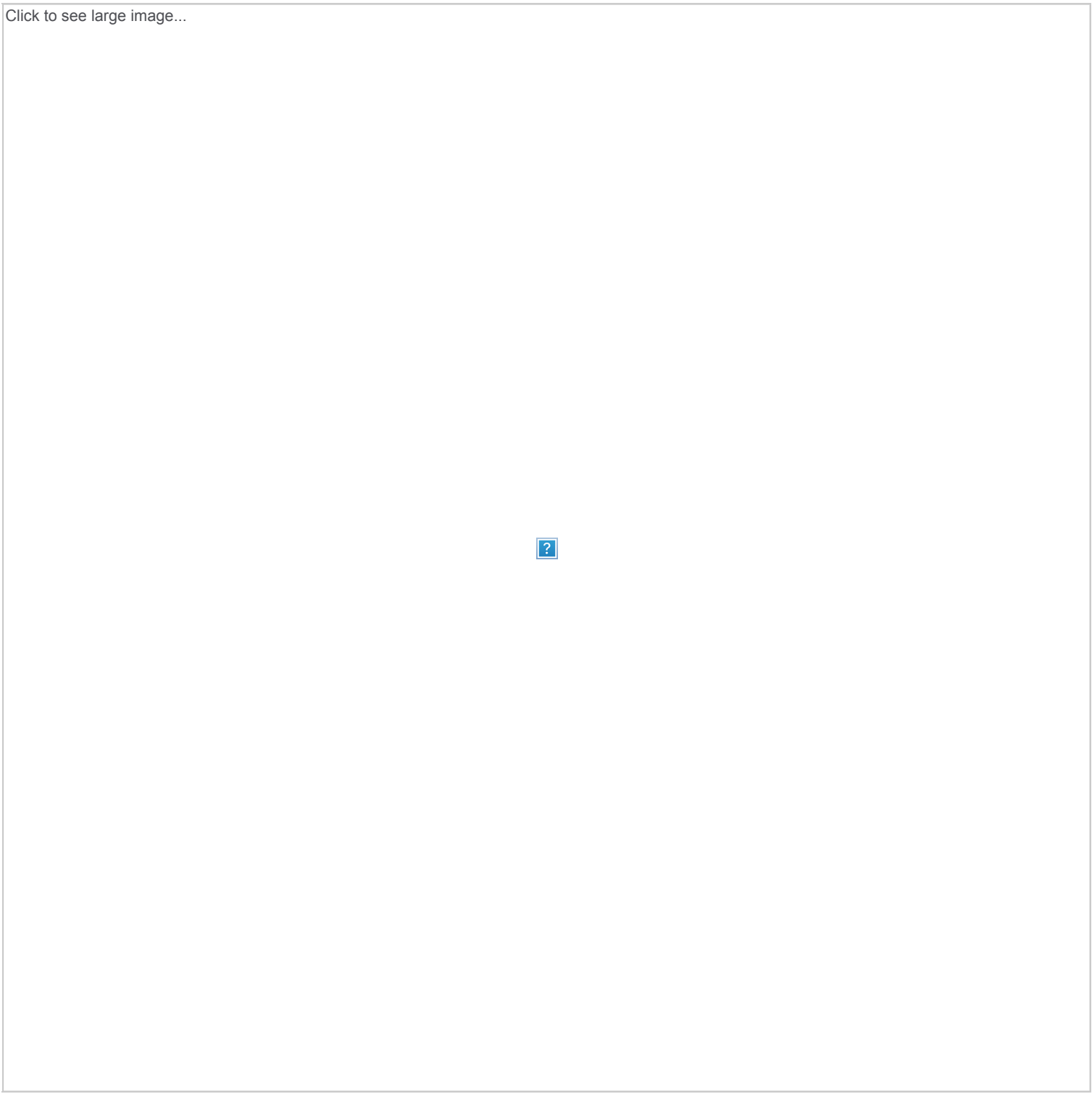
1. Install the occupant alert sensor.
2. Connect the negative (-) battery terminal.

- Description

The immobilizer system will disable the vehicle unless the proper ignition key is used, in addition to the currently available anti-theft systems such as car alarms, the immobilizer system aims to drastically reduce the rate of auto theft.

1. Transponder (TP) – IMMO ECU Communication

Click to see large image...



TP Read Protocol

(1) IMMO_ECU after IGN on(or CPU Reset cancellation) is sent Challenge to TP and confirmed Serial Number and Signature.

(2) When response of input transponder is not correct, input is retry.

(3) When response of input transponder is correct, The data that calculate Encryption operation in the EEPROM program compared with received data from TP.

When Codes is same, input is finished.

If the codes are not same, input are continued until when codes are same.

(4) If IMMO_ECU EEPROM code is not programming, when correct transponder is inputted (CRC Check OK), input is finished.

(5) After IGN1 on(CPU Reset cancellation), IMMO_ECU is reading the maximum 5times Transponder Code

(6) In the IGN1 ON&EMS_state=Lock state, when received ANKNOWLEDGE, TP is re-authenticated

Click to see large image...

2. Transponder / IMMO ECU / EMS authentication

Click to see large image...

- Components Operations

PCM (Power Train Control Module)

1. The PCM(ECM) (A) carries out a check of the ignition key using a special encryption algorithm, which is programmed into the transponder as well as the PCM(ECM) simultaneously. Only if the results are equal, the engine can be started. The data of all transponders, which are valid for the vehicle, are stored in the PCM(ECM).

   ERN (Encrypted Randorm Number) value between EMS and encrypted smartra unit is checked and the validity of coded key is decided by EMS.

Click to see large image...

ENCRYPTED IMMOBILIZER unit (A)

The IMMOBILIZER carries out communication with the built-in transponder in the ignition key. This wireless communication runs on RF (Radio frequency of 125 kHz). The IMMOBILIZER is mounted behind of the crash pad close to center cross bar.

The RF signal from the transponder, received by the antenna coil, is converted into messages for serial communication by the IMMOBILIZER device. And, the received messages from the PCM(ECM) are converted into an RF signal, which is transmitted to the transponder by the antenna.

The IMMOBILIZER does not carry out the validity check of the transponder or the calculation of encryption algorithm. This device is only an advanced interface, which converts the RF data flow of the transponder into serial communication to the PCM(ECM) and vice versa.

Click to see large image...

Transponder (Built-in keys)

The transponder has an advanced encryption algorithm. During the key teaching procedure, the transponder will be programmed with vehicle specific data. The vehicle specific data are written into the transponder memory. The write procedure is once only; therefore, the contents of the transponder can never be modified or changed.

[Master Folding Key]

[Assistant Master Key]

Click to see large image...

Antenna Coil

The antenna coil (A) has the following functions.

- The antenna coil supplies energy to the transponder.
- The antenna coil receives signal from the transponder.
- The antenna coil sends transponder signal to the IMMOBILIZER.

It is located directly in front of the steering handle lock.

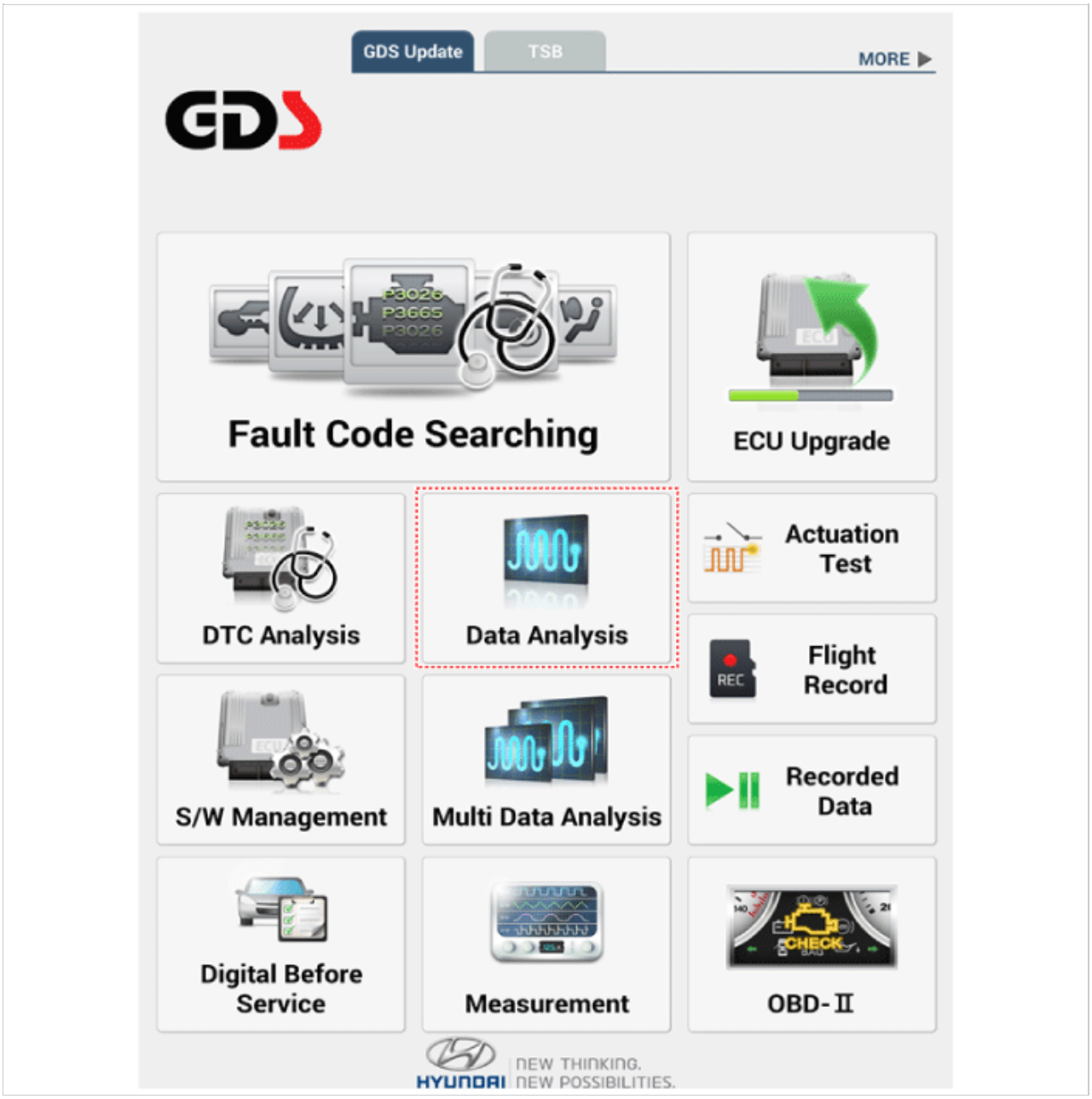
Click to see large image...

- Diagnosis with Diagnostic tool

1. In the body electrical system, failure can be quickly diagnosed by using the vehicle diagnostic system (Diagnostic tool).
   The diagnostic system (Diagnostic tool) provides the following information.
   (1) Fault Code Searching : Checking failure and code number (DTC)
   (2) Data Analysis : Checking the system input/output data state
   (3) Actuation test : Checking the system operation condition
   (4) S/W Management : Controlling other features including system option setting and zero point adjustment

Data Analysis

1. Select the 'Data Analysis' and 'Car model'.



2. Select the 'IMMO' to search the current state of the input/output data.

Click to see large image...

Key Teaching Procedure

Key teaching must be done after replacing a defective PCM(ECM) or when providing additional keys to the vehicle owner.

The procedure starts with an PCM(ECM) request for vehicle specific data (PIN code: 6digits) from the tester. The "virgin" PCM(ECM) stores the vehicle specific data and the key teaching can be started. The "learnt" PCM(ECM) compares the vehicle specific data from the tester with the stored data. If the data are correct, the teaching can proceed.

If incorrect vehicle specific data have been sent to the PCM(ECM) three times, the PCM(ECM) will reject the request of key teaching for one hour. This time cannot be reduced by disconnecting the battery or any other manipulation. After reconnecting the battery, the timer starts again for one hour.

The key teaching is done by ignition on with the key and additional tester commands. The PCM(ECM) stores the relevant data in the EEPROM and in the transponder. Then the PCM(ECM) runs the authentication required for confirmation of the teaching process. The successful programming is then confirmed by a message to the tester.

If the key is already known to the PCM(ECM) from a previous teaching, the authentication will be accepted and the EEPROM data are updated. There is no changed transponder content (this is impossible for a learnt transponder).

The attempt to repeatedly teach a key, which has been taught already during the same teaching cycle, is recognized by the PCM(ECM). This rejects the key and a message is sent to the tester.

The PCM(ECM) rejects invalid keys, which are presented for teaching. A message is sent to the tester. The key can be invalid due to faults in the transponder or other reasons, which result from unsuccessful programming of data. If the PCM(ECM) detects different authenticators of a transponder and an PCM(ECM), the key is considered to be invalid.

The maximum number of taught keys is 4.

If an error occurs during the Immobilizer Service Menu, the PCM(ECM) status remains unchanged and a specific fault code is stored.

If the PCM(ECM) status and the key status do not match for teaching of keys, the tester procedure will be stopped and a specific fault code will be stored at PCM(ECM).

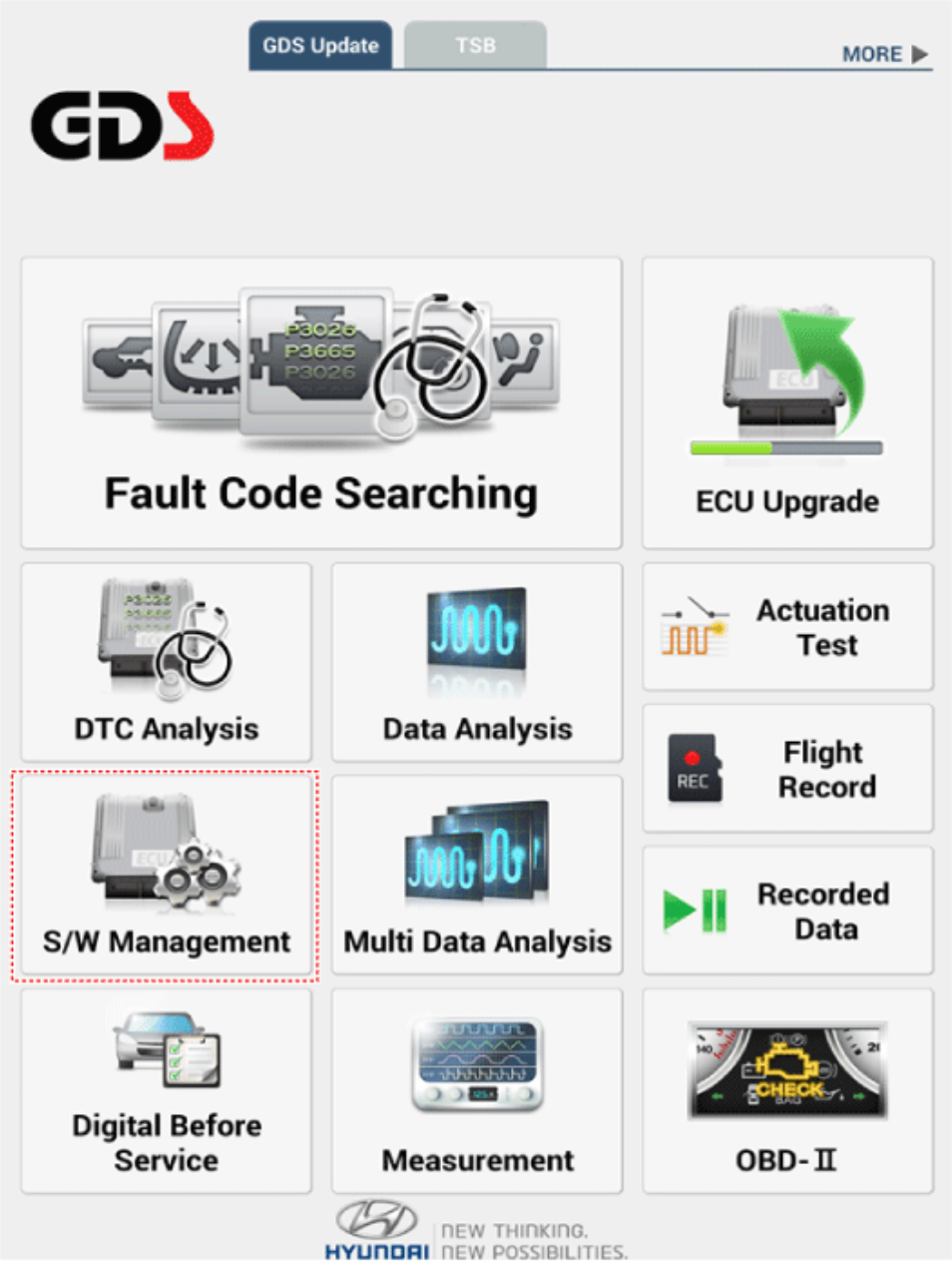
NOTICE

- When teaching the 1st key, Smartra regists at the same time.

Click to see large image...

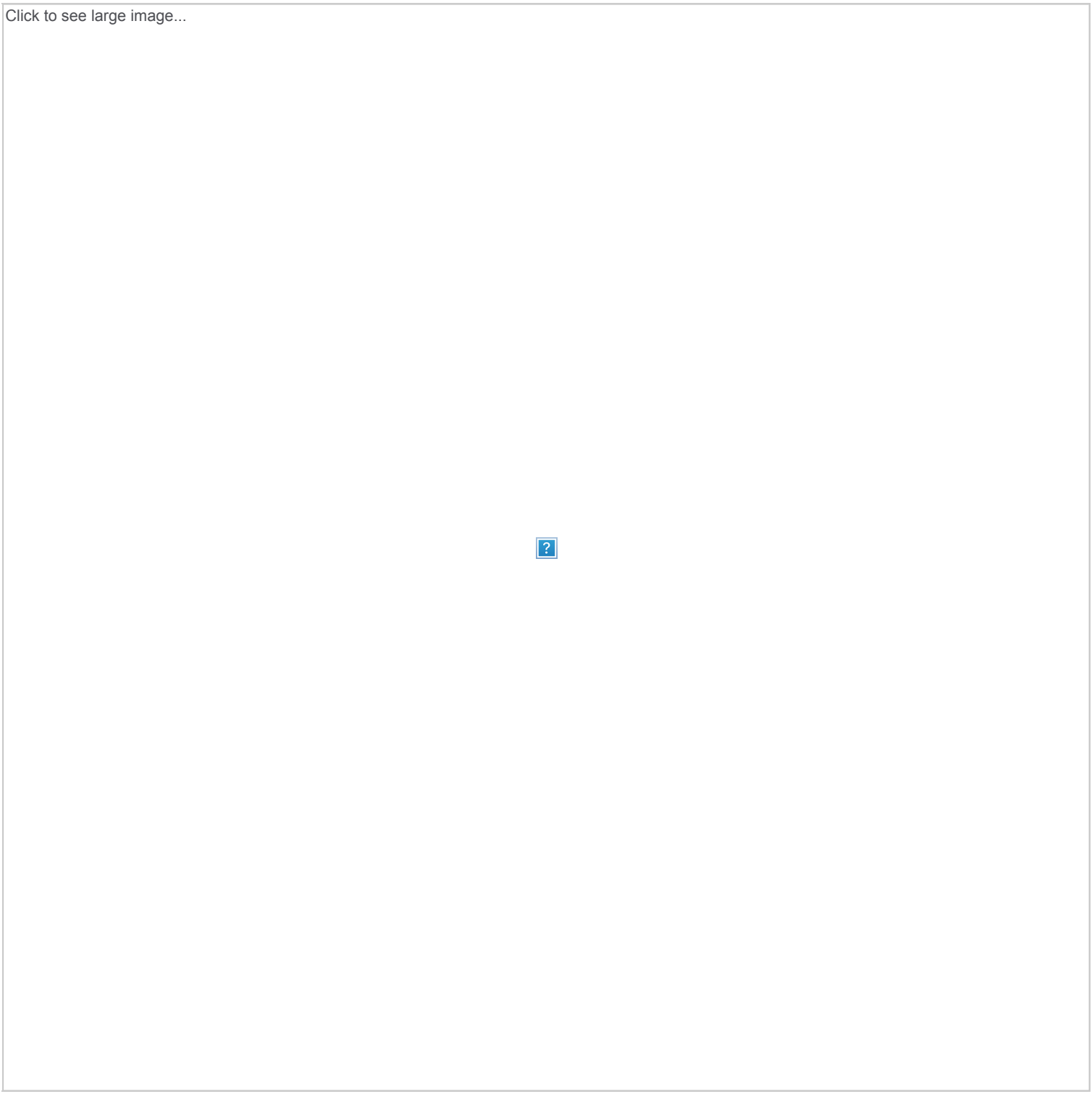
The following section describes how to diagnose faults using a diagnostic instrument.

1. Connect the cable of Diagnostic tool to the data link connector in driver side crash pad lower panel, and turn on the Diagnostic tool.
2. Select the 'S/W Management' and 'Car model'.



3. Select "Imoobilizer" and "LEARNT KEYS".

Click to see large image...



4. Perform the "LEARNT KEYS" procedure according to the Diagnostic tool screen message.

Password Teaching / Changing

The user password for limp home is taught at the service station. The owner of the vehicle can select a number with four digits.

The user password teaching is only accepted by a "learnt" PCM(ECM). Before first teaching of user password to an PCM(ECM), the status of the password is "virgin" No limp home function is possible.

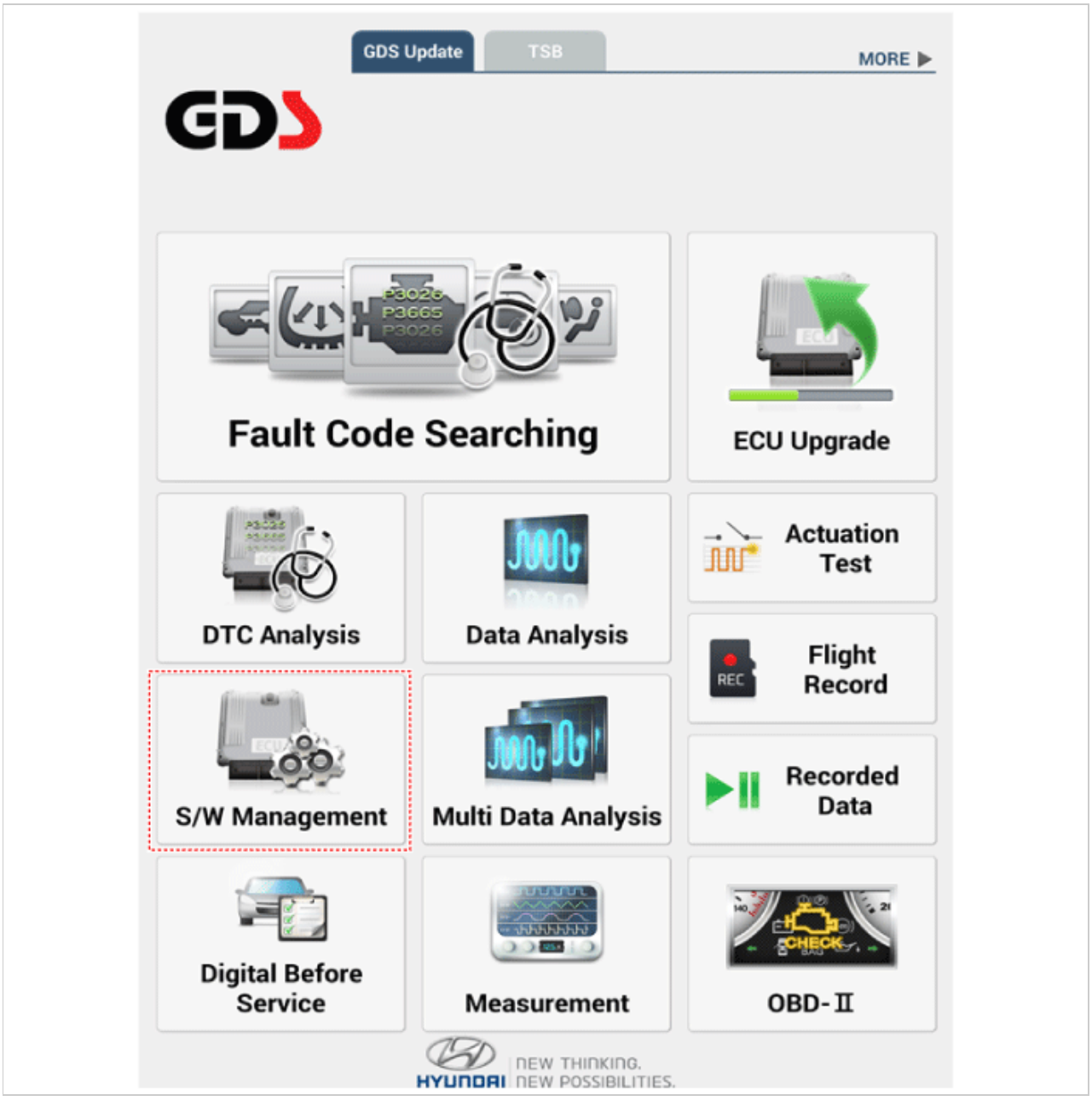
The teaching is started by ignition on, with a valid key(learnt key) and sending the user password by tester. After successful teaching, the status of the user password changes from "virgin" to "learnt".

The learnt user password can also be changed. This can be done if the user password status is "learnt" and the tester sends authorization of access, either the old user password or the vehicle specific data. After correct authorization, the PCM(ECM) requests the new user password. The status remains "learnt" and the new user password will be valid for the next limp home mode.

If wrong user passwords or wrong vehicle specific data have been sent to the PCM(ECM) three times continuously or intermittently, the PCM(ECM) will reject the request to change the password for one hour. This time cannot be reduced by disconnecting the battery or any other actions. After reconnecting the battery, the timer starts again for one hour.

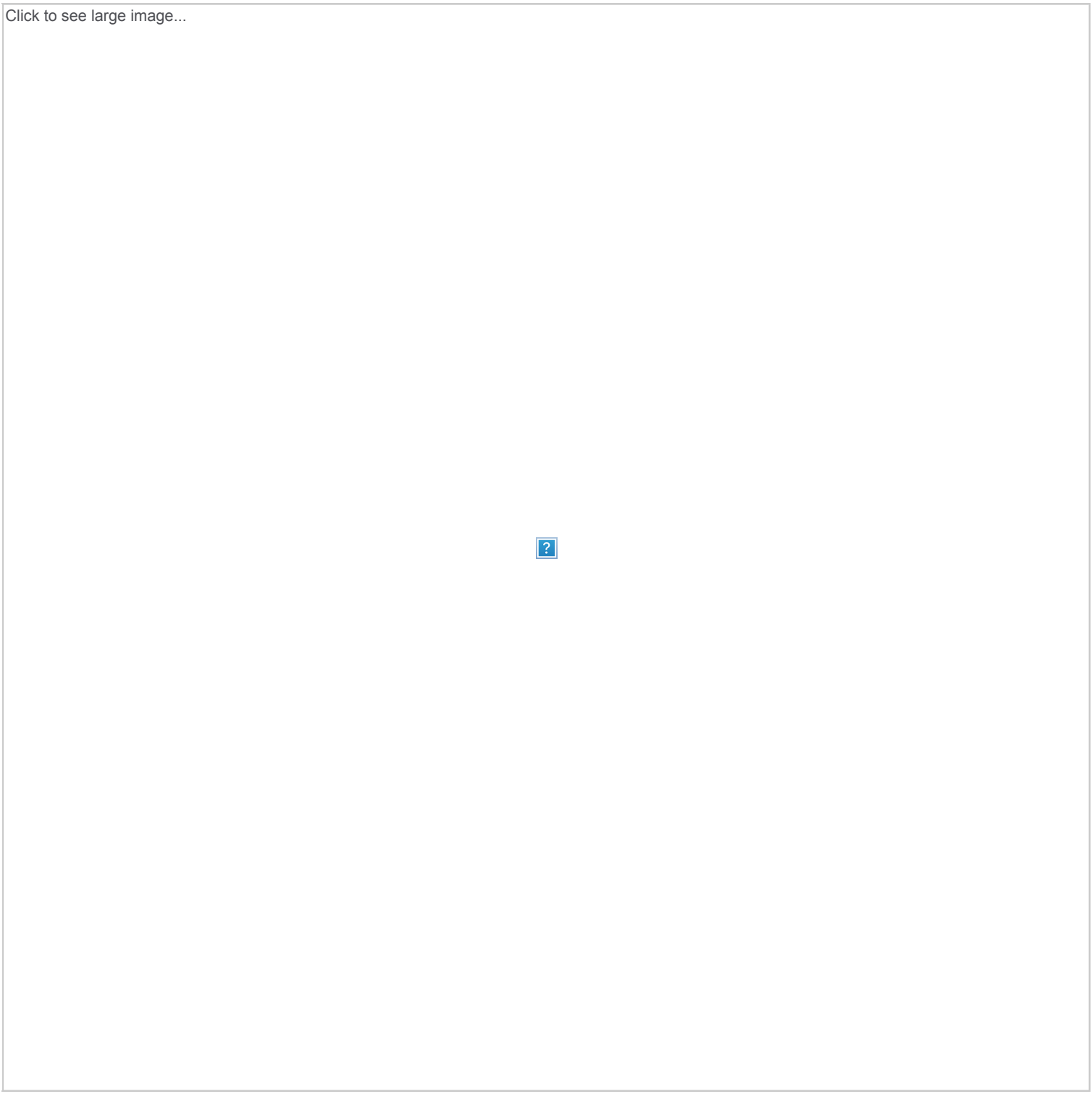
The following section describes how to diagnose faults using a diagnostic instrument.

1. Connect the cable of Diagnostic tool to the data link connector in driver side crash pad lower panel, and turn on the Diagnostic tool.
2. Select the 'S/W Management' and 'Car model'.



3. Select "Imoobilizer" and "Password Teaching / Changing".

Click to see large image...



4. Perform the "Password Teaching / Changing" procedure according to the Diagnostic tool screen message.

Limp Home Function

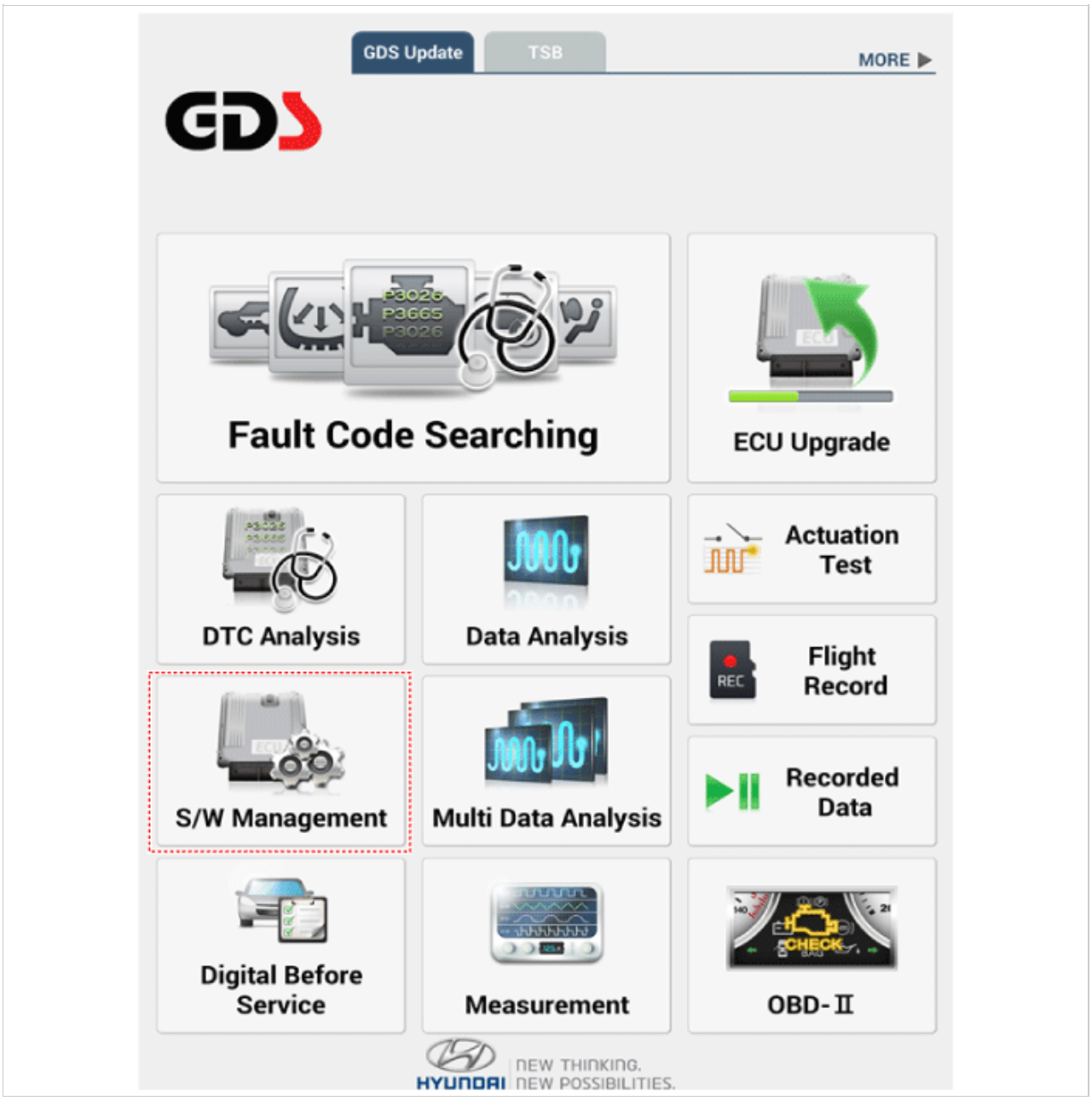
If the PCM(ECM) detects the fault of the SMARTRA or transponder, the PCM(ECM) will allow limp home function of the immobilizer. Limp home is only possible if the user password (4 digits) has been given to the PCM(ECM) before. This password can be selected by the vehicle owner and is programmed at the service station.

The user password can be sent to the PCM(ECM) via the special tester menu.

Only if the PCM(ECM) is in status "learnt" and the user password status is "learnt" and the user password is correct, the PCM(ECM) will be unlocked for a period of time (30 sec.). The engine can only be started during this time. After the time has elapsed, engine start is not possible.

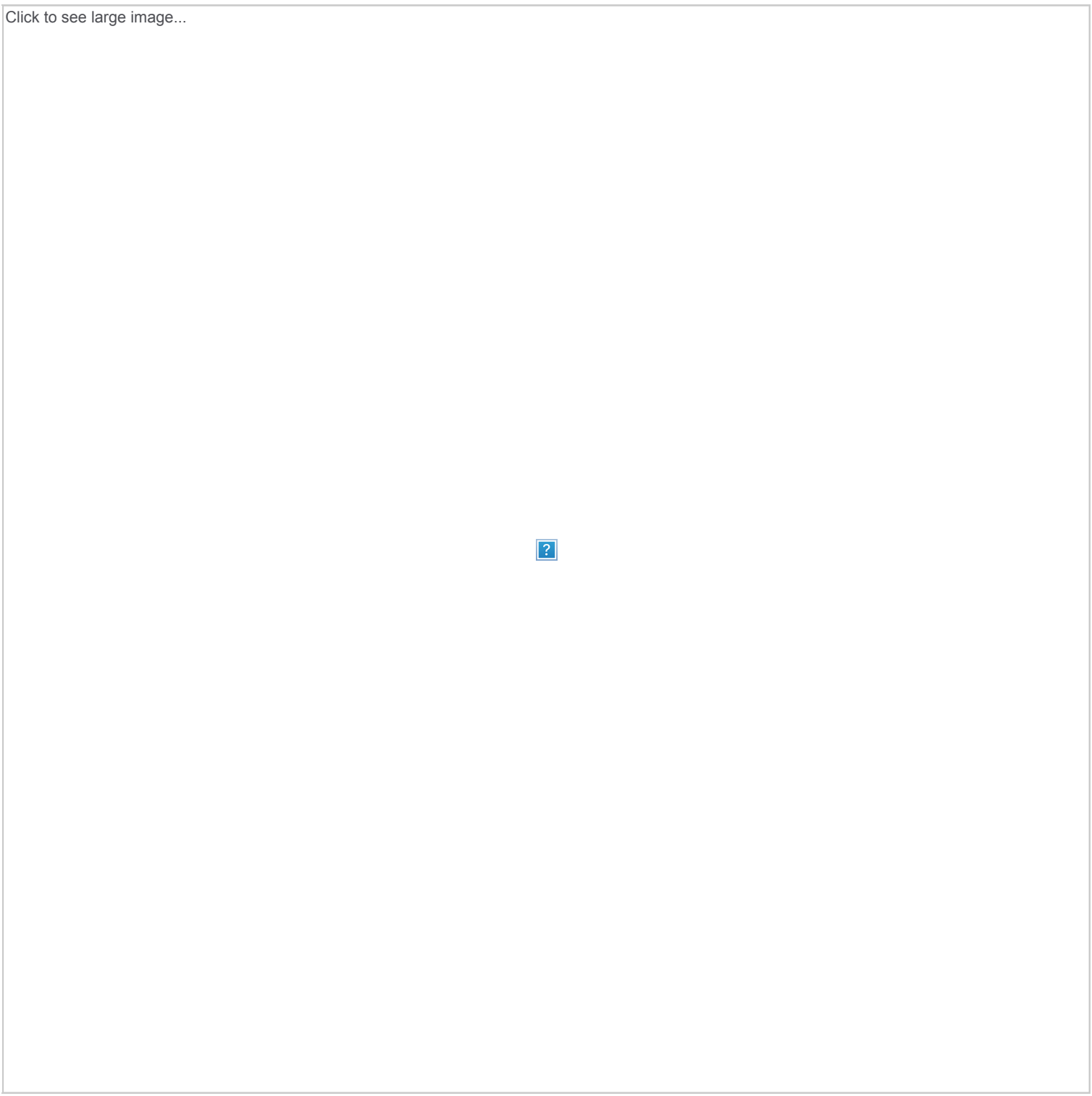
If the wrong user password is sent, the PCM(ECM) will reject the request of limp home for one hour. Disconnecting the battery or any other action cannot reduce this time. After connecting the battery to the PCM(ECM), the timer starts again for one hour.

1. Connect the cable of Diagnostic tool to the data link connector in driver side crash pad lower panel, and turn on the Diagnostic tool.
2. Select the 'S/W Management' and 'Car model'.



3. Select "Imoobilizer" and "Limp Home Mode".

Click to see large image...



4. Perform the "Limp Home Mode" procedure according to the Diagnostic tool screen message.

Neutralizing Of ECM

The PCM(ECM) can be set to the "neutral" status by a tester.

A valid ignition key is inserted and after ignition on is recorded, the PCM(ECM) requests the vehicle specific data from the tester. The communication messages are described at "Neutral Mode" After successfully receiving the data, the PCM(ECM) is neutralized.

The ECM remains locked. Neither the limp home mode nor the "twice ignition on" function, is accepted by the PCM(ECM).

The teaching of keys follows the procedure described for the virgin PCM(ECM). The vehicle specific data have to be unchanged due to the unique programming of the transponder. If data should be changed, new keys with a virgin transponder are requested.

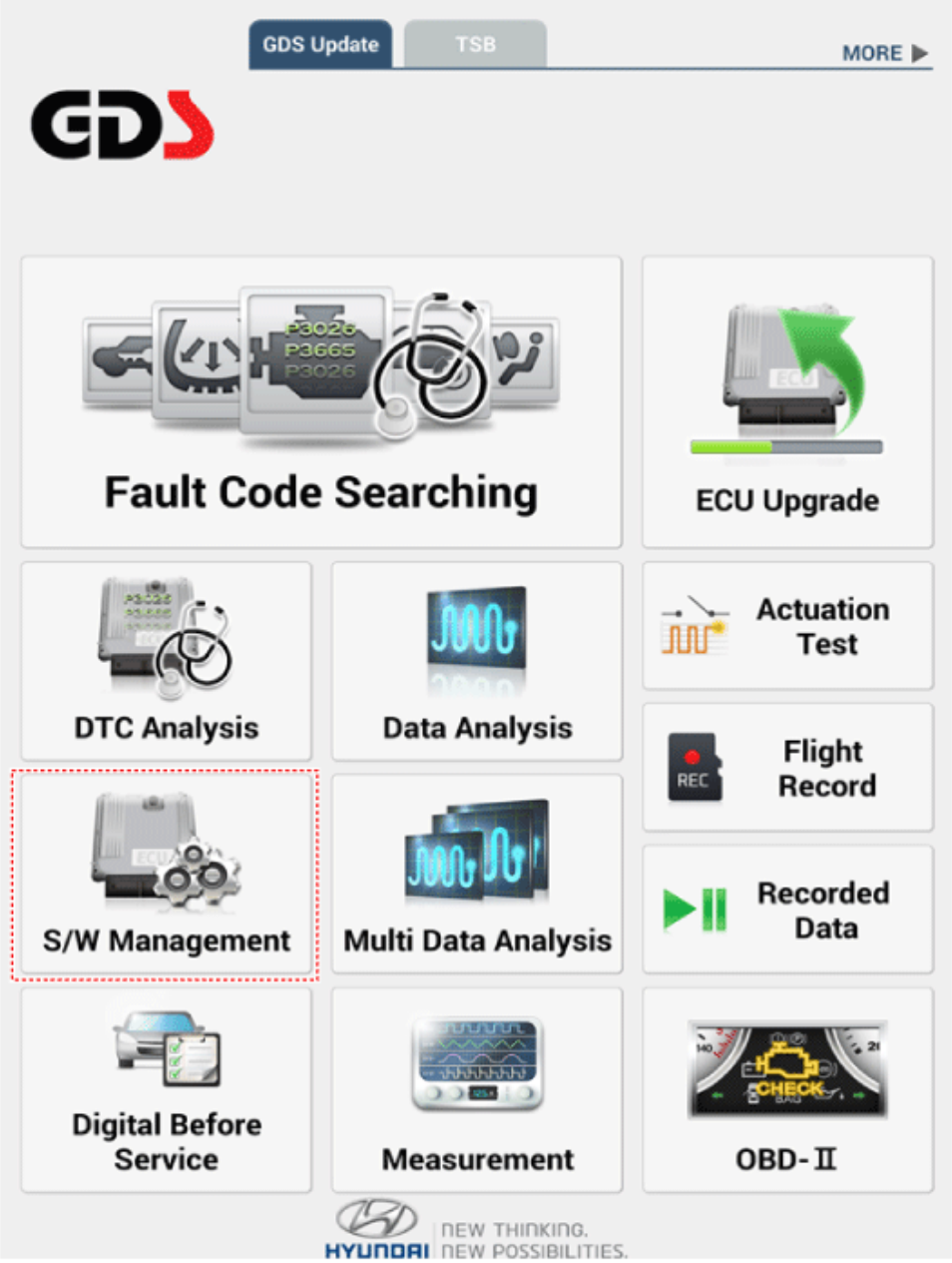
This function is for neutralizing the PCM(ECM) and Key. Ex) when lost key, Neutralize the PCM(ECM) then teach keys.

(Refer to the Things to do when Key & PIN Code the PCM(ECM) can be set to the "neutral" status by a scanner. If wrong vehicle specific data have been sent to SMATRA three times continuously or intermittently, the SMATRA will reject the request to enter neutral mode for one hour. Disconnecting the battery or other manipulation cannot reduce this time. After connecting the battery the timer starts again for one hour.

NOTICE

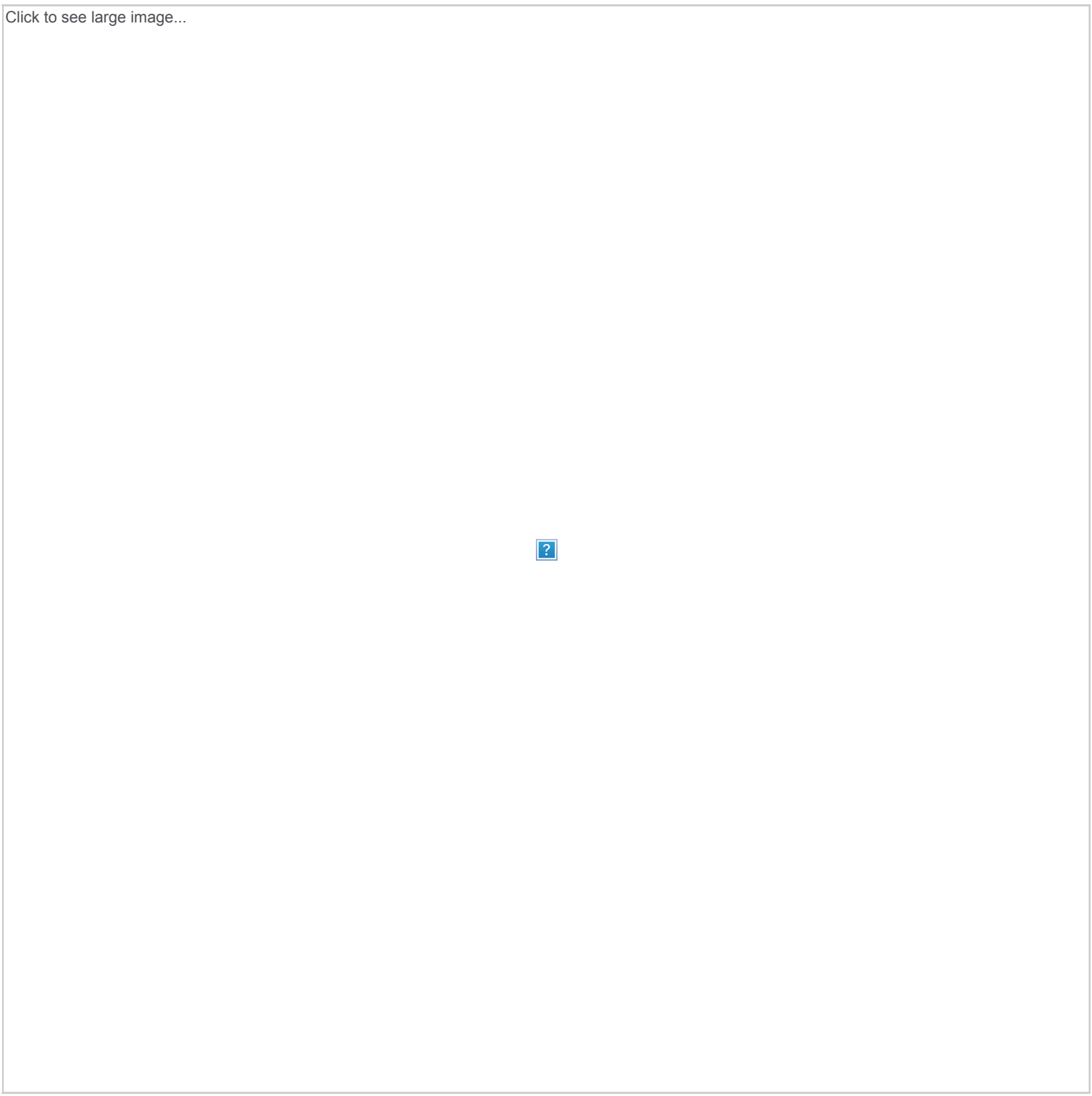
- Neutralizing setting condition
  - In case of PCM(ECM) status "Learnt" regardless of user password "Virgin or Learnt"
  - Input correct PIN code by scanner.
  - Neutralizing meaning .
  : PIN code (6) & user password (4) deletion.
  : Locking of ECM (except key teaching permission)
- Neutralizing meaning:
  - PIN Code(6) & User P/Word(4) deletion
  - Locking of EMS(except Key Learning permission)

1. Connect the cable of Diagnostic tool to the data link connector in driver side crash pad lower panel, and turn on the Diagnostic tool.
2. Select the 'S/W Management' and 'Car model'.



3. Select "Imoobilizer" and "Limp Home Mode".

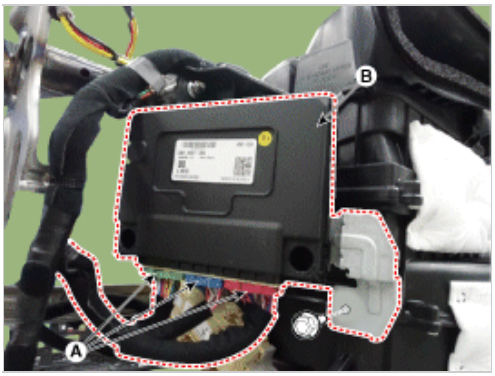
Click to see large image...

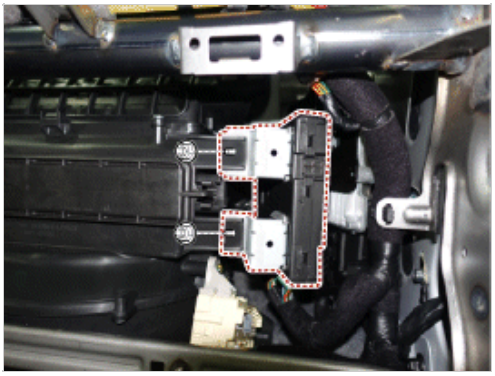


4. Perform the "Limp Home Mode" procedure according to the Diagnostic tool screen message.

- Removal

1. Disconnect the negative (-) battery terminal.
2. Remove the glove box housing.
   (Refer to Body - "Glove Box Housing Cover")
3. Disconnect the connector (A) and then remove the IBU (B) after loosening mounting nuts.





- Installation

1. Install the IBU after connecting the unit connector.
2. Install the glove box housing.
3. Connect the negative (-) battery terminal.

- Removal

1. Disconnect the negative (-) battery terminal.
2. Remove the crash pad lower panel.
   (Refer to Body - "Crash Pad Lower Panel")
3. Disconnect the 6P connector (B) of the coil antenna and then remove the coil antenna (A) after loosening the screw.

Click to see large image...

- Installation

1. Install the coil antenna and connect the 6P connector.
2. Install the crash pad lower panel.
3. Connect the negative (-) battery terminal.

- Component Location

Click to see large image...

1. Start Stop Button(SSB)
2. FOB key
3. Tailgate open switch
4. Interior antenna 1
5. Interior antenna 2
6. Intergrated Body Control Unit (IBU)
7. Trunk antenna
8. Door handle & door antenna
9. Bumper antenna

- Description

System Overview

The System offers the following features:

- Changing the state of engine ignition and power by using the start button.
- Controlling external relays for ACC / IGN1 / IGN2 terminal switching and STARTER, without use of mechanical ignition switch.
- Indicating the vehicle status on display by using LED or explicit messages.
- Immobilizer function by LF transponder communication between fob and fob holder.
- Redundant architecture for high system dependability .
- Interface with Low Speed CAN vehicle communication network.
- Interface with LIN vehicle communication network depending on platform .

The RKE and SMART KEY functions are not considered part of this Button Engine Start system and are specified in a separate system.

System Main Function

- Switching of ACC / IGN1 / IGN2 terminals.
- Control of the STARTER relay BAT line (high side) based on communication with EMS ECU.
- Management of the Immobilizer function.
- Management of BES warning function.

Button Engine Start System

The Button Start System allows the driver to operate the vehicle by simply pressing a button (called as SSB) instead of using a standard mechanical key.

If the driver presses the SSB while prerequisites on brakes, fob authentication and transmission status are satisfied, the BES System will proceed with the locking/unlocking of the steering column, the control of the terminal, and the cranking of the engine.

The driver can release the SSB as soon as this sequence is initiated. After positive response from immobilizer interrogation, the system will activate the starter motor and communicate with the EMS to check the engine running status for starter release.

The driver will be able to stop the engine by a short push on the SSB if the vehicle is already in standstill. Emergency engine stop will be possible by a long press of the SSB or 3 consecutive presses in case the vehicle is in ENGINE RUNNING.

If the conditions for engine cranking are not satisfied while a push on the SSB is detected and a valid fob authenticated, the system will unlock the steering column and switch the terminals to IGN. Another push on the SSB will be necessary to start the engine.

In case of a vehicle equipped with SMART KEY system, fob authentication will not require any action from the driver. For limp home start or in case of vehicle without SMART KEY, the driver will have to insert the fob into the fob holder.

Click to see large image...

- Control Ignition and engine ON/OFF by Sending signal to IPM.
- Display status by LED Lamp ON/OFF. (Amber or Green)

Indicator ON/OFF Condition At Ignition Key Off Condition

No	Character lamp	Conditions
1	Indicator Lamp ON	Door open, Tail lamp ON, ACC, IG ON
2	Indicator Lamp 30sec ON → Lamp OFF	Door close, Tail lamp OFF, IG OFF
3	Indicator Lamp OFF	Remote LOCK, Passive LOCK
4	Rheostat at tail lamp ON (Illumination lamp)	

Indicator ON/OFF Condition According To Ignition Key's Position

No	Ignition conditions	Start Button LED status
1	IG OFF	White color LED ON
2	IG ACC	Amber color LED ON
3	IG ON (Engine OFF)	Green color LED ON
4	Cranking	Maintain LED status before cranking
5	Engine running	LED OFF

Operation for each function of button starting

1. Electric power ON / Ignition ON
   - The electric power state changes within the range of OFF →ACC→IGN→OFF by pressing the button without stepping on the brake (Or with stepping on the brake) inside the car with FOB key (However, When the gear is not in P, the power repeatedly changes between ACC and IGN. Converting to OFF is impossible.)
   - The ignition is on when the button is pressed with stepping on the brake at P/N position with FOB key.

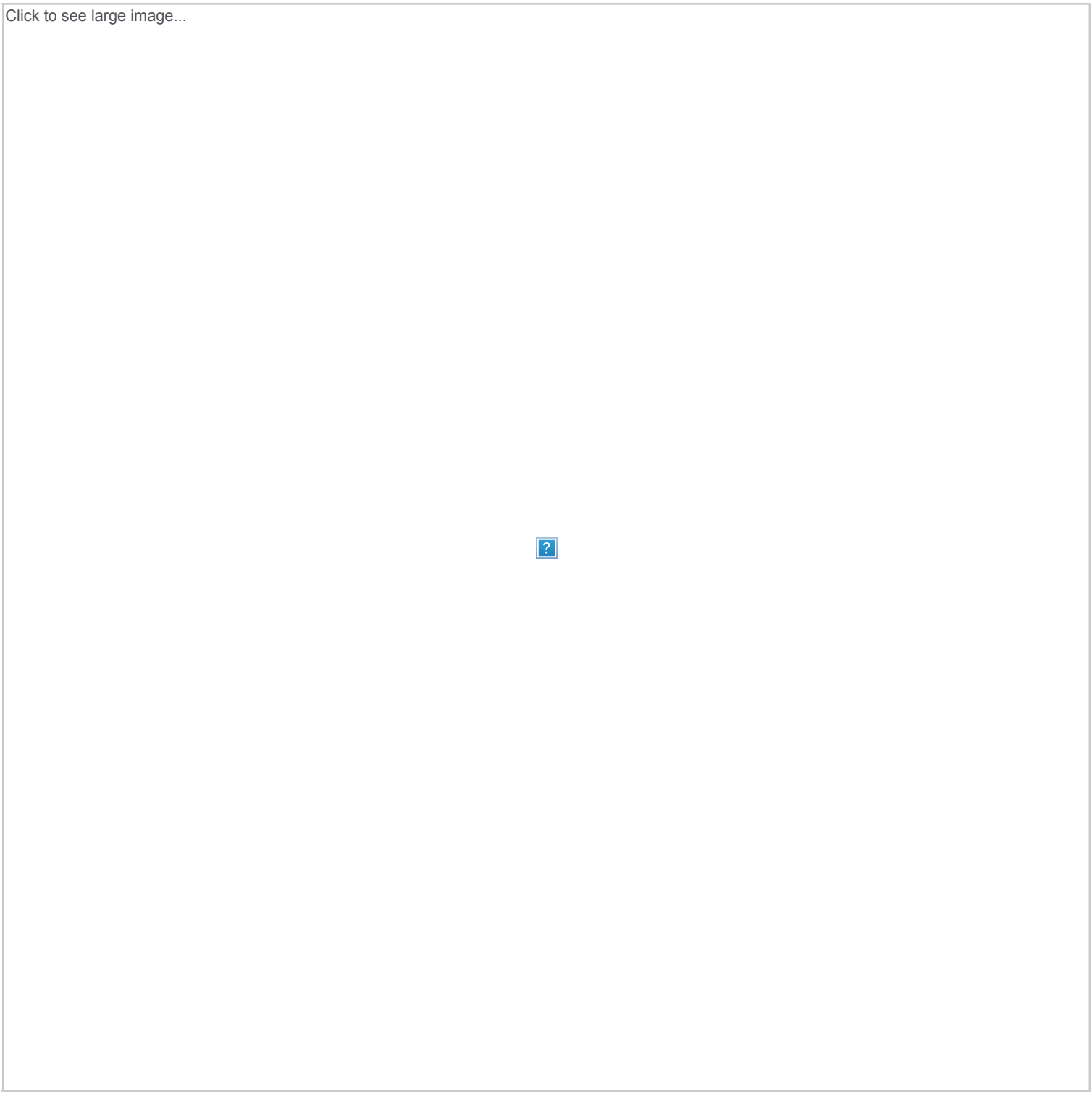
Click to see large image...

2. Electric power OFF/ Ignition OFF
   – The ignition OFF is possible in the state of vehicle stop. (The ignition OFF state is possible regardless of the ATM lever position.)
   – The lever shall be shifted for parking in gear N by pressing the ATM lever release button after electric power off in P.

Click to see large image...

3. How to off the ignition forcibly and to restart during driving
   - It is a method of forcibly turning off ignition in case of fuel leakage when the vehicle is overturned or of emergency (e.g. failure in accelerator pedal return)
   - The engine is off and returned to the ACC state when the button is pressed for 2 seconds and more than 3 times successively within 3 seconds during driving. The restarting is available for next 30 seconds regardless of FOB key and the electric power is changed through OFF → ACC→IGN→OFF by pressing the button without stepping on the brake (or with stepping on the brake) inside the car with FOB key. (However, when it is not in P position, ACC↔IGN is repeated. The conversion to OFF is impossible.)

Click to see large image...



4. Function of 0.5 second delay for brake switch input.
   The starting is available when the brake pedal is stepped on within 0.5 second after pressing the start button in engine OFF state.
5. State of start button indicator (LED) ON depending on the electric power state.
   – Electric power OFF : LED OFF
   – Electric power ACC state : Yellow LED ON
   – Electric power ON : Blue LED ON
   – During cranking : Maintaining the previous LED ON state before cranking
   – Starting ON state : LED OFF

IBU (Integrated Body Control Unit (IBU)

Click to see large image...

The IBU manages all function related to:

- "Start Stop Button (SSB) monitoring",
- "Immobilizer communication" (with Engine Management System unit for immobilizer release),
- "Authentication server" (Validity of Transponder and in case of Smart Key option Passive Fob authentication),
- "System consistency monitoring",
- "System diagnosis",
- Control of display message / warning buzzer .

The smart key unit masters the entire button engine start system.

In case of SMART KEY application, for example "Passive Access", "Passive Locking" and "Passive Authorization are integrated for Terminal switching Operations".

It collects information about vehicle status from other modules (vehicle speed, alarm status, driver door open...), reads the inputs (e.g. SSB, Capacitive Sensor / Lock Button, PARK position Switch), controls the outputs (e.g. exterior and interior antennas), and communicates with others devices via the CAN network as well as a single-line interfaces.

The diagnosis and learning of the components of the BES System are also handled by the SMK.

The SMK manages the functions related to the "terminal control" by activating external relays for ACC, IGN1 and IGN2. This unit is also responsible for the control of the STARTER relay.

The SMK is also controlling the illumination of the SSB as well as the "system status indicator", which consists of 2 LEDs of different color. The illumination of the fob holder is also managed by the SMK.

The SMK reads the inputs (Engine fob in, vehicle speed, relays contact status), controls the outputs (Engine relay output drive), and communicates with others devices via the CAN.

The internal architecture of the SMK is defined in a way that the control of the terminal is secured even in case of failure of one of the two microcontrollers, system inconsistency or interruption of communication on the CAN network.

In case of failure of one of the two controllers, the remaining controller shall disable the starter relay. The IGN1 and IGN2 terminals relays shall be maintained in the state previously memorized before the failure and the driver shall be able to switch those IGN terminals off by pressing the SSB with EMERGENCY_STOP pressing sequence. However, engine restart will not be allowed. The state of the ACC relay will depend on the type of failure.

The main functions of the SMK are:

- Control of Terminal relays
- Monitoring of the Vehicle speed received from sensor or ABS/ESP ECU.
- Control of SSB LEDs (illumination, clamp state).
- Control of the base station located in SSB through direct serial interface.
- System consistency monitoring to diagnose SMK failure and to switch to relevant limp home mode.
- Providing vehicle speed information
- Start Stop Button (SSB) monitoring
- Starter power control

Start/Stop Button (SSB)

A single stage push button is used for the driver to operate the vehicle. Pressing this button allows:

- To activate the power modes ‘Off’, ’Accessory’, ‘Ignition’ and 'Start' by switching the corresponding terminals
- To start the engine
- To stop the engine

The contact will be insured by a micro-switch and a backlighting is provided to highlight the marking of the button whenever necessary.

Three (3) LED colors are located in the outside ring of the switch assy. They display the status of the system.

They are OFF(White) / ACC(Amber) / ON(Green).

Click to see large image...

BES(Button Engine Start) System State Chart

System STATES in LEARNING MODE

In learning mode, the BES System can be set in 6 different states, depending on the status of the terminals and Engine status:

System State	Terminal Status	Engine status
1. OFF - Locked	OFF	Stopped
2. OFF - Unlocked	OFF	Stopped
3. ACC	ACC	Stopped
4. IGN	IGN1, IGN2, ACC	Stopped

5. Start	IGN1, Start	Cranking
6. IGN - Engine	IGN1, IGN2, ACC	Running (means "self-running")

Referring to the terminals, the system states described in the table above are the same as those found in a system based on a mechanical ignition switch.
One of the features distinctive from the Mechanical Ignition Switch-based system is that the BES system allows specific transition from [OFF] to [START] without going through [ACC] and [IGN] states.

System STATES IN VIRGIN MODE

The BES System can be set in 5 different states (OFF LOCKED is not available in virgin mode), depending on the status of the terminals and Engine status :

System State	Terminal Status	Engine status
1. OFF - UNLOCKED	OFF	Stopped
2. ACC	ACC	Stopped
3. IGN	IGN1, IGN2, ACC	Stopped
4. Start	IGN1, START with special pattern of activation	Cranking
5. IGN - Engine	IGN1, IGN2, ACC	Running (means "self-running")

Referring to the terminals, the system states described in the table above are the same as those found in a system based on a mechanical ignition switch.
One of the features distinctive from the Mechanical Ignition Switch-based system is that the BES system allows specific transition from [OFF] to [START] without going through [ACC] and [IGN] states.

- Component

Click to see large image...

- Removal

1. Disconnect the negative (-) battery terminal.
2. Remove the crash pad center garnish.

Click to see large image...

3. Disconnect the start/stop button connector.

Click to see large image...

4. Remove the start/stop button (A) after removing the screws.

Click to see large image...

- Installation

1. Install the start/stop button.
2. Install the crash pad center garnish.
3. Connect the negative (-) battery terminal.

- Component Location

Click to see large image...

1. Rear view camera
2. AVN monitor

- Circuit Diagram

Click to see large image...

- Description

Back view camera will activate when the backup light is ON with the ignition switch ON and the shift lever in the R position.

This system is a supplemental system that shows behind the vehicle through the AV monitor or the ECM (Reverse Display Room Mirror) mirror while backing-up.

WARNING

This system is a supplementary function only. It is the responsibility of the driver or always check the inside/ outside rearview mirror and the area behind the vehicle before and while backing up because there is a dead zone that can't see through the camera.

- Removal

1. Disconnect the negative (-) battery terminal.
2. Remove the tailgate trim.
   (Refer to Body - "Tailgate Trim")
3. Remove the tailgate back panel.
   (Refer to Body - "Tailgate Back Panel")
4. Disconnector the connector (A) and then remove the rear view camera after loosening mounting screws.

Click to see large image...

- Installation

1. Install the rear view camera.
2. Install the and tailgate back panel.
3. Install the and tailgate trim.
4. Connect the negative (-) battery terminal.

- Components

Click to see large image...

Information

1) SVM unit basically use C-CAN signal only to communicate about the vehicle's condition.
- Steering wheel angle sensor : C-CAN
- Vehicle speed sensor : C-CAN

2) Other unit's B-CAN, P-CAN, MM-CAN signal is changed to C-CAN signal and sent to SVM unit by CGW (Central Gate Way).
- AVN monitor : MM-CAN
- Transmission : P-CAN (TCM unit)
- PDW sensor : B-CAN (BCM)

Component Functions

No	Components	Quantity	Major Role
1	SVM Unit	1	– Input video information from 4 channel cameras and process display – Vehicle communication (CAN) and system control – Screen output in 8 view modes
2	Ultra optical camera (190 degrees)	4	– Record vehicle's surrounding area
3	AVN Head Unit	1	– Provide driver with video via SVM ECM output – Send user input data to SVM ECU
4	SVM Switch	1	– Input video feed in Front Mode

- Description

Surround View Monitor (SVM) is the system that allows video monitoring of 360 degrees around the vehicle. The system includes 4 ultra optical camera mounted around the vehicle (front, both sides, rear).

The video from these cameras are applied with distortion compensation, time point conversion, and video merging technologies to provide sky-view image of the vehicle's surrounding area, as well as various other view modes.

The SVM System provides video feed of the vehicle's surrounding area while parking or during low speed driving to the driver to enhance safety and driver's convenience.

In addition, the system also displays video image of vehicle's surrounding area, and includes steering wheel synchronized guide line indication, front and rear object warning, and A/S (including In-Line) tolerance compensation features.

Click to see large image...

It's a system that displays the video, from ultra optical cameras mounted on 4 sides of the vehicle, on the Head Unit Screen. It shows 360 degrees sky-view image of the vehicle's surrounding area, as well as various other view modes. The SVM System provides video feed of the vehicle's surrounding area while the vehicle is parked or during low speed driving to the driver to enhance safety and driver's convenience.

- Major Features

1. Display Vehicles Surrounding in Video

   The surrounding area video display function displays the 360 degrees video image captured through 4 cameras to the driver through the Head Unit Screen while the vehicle is moving at low speed or going reverse. The SVM System displays total of 8 video modes for displaying surrounding video based on the vehicle driving state and the driver's selection.

2. Guide Line Indication & Steering Wheel Synchronized Feature

The Guide Line Indication & Steering Wheel Synchronized Feature is the function that assists the driver in parking by synchronizing the steering wheel with the rear view video display marked with a guide line to help anticipate the direction of the vehicle going reverse.

3. Front/Rear Object Warning (Obstacle Detection Feature)
   The system receives obstacle warning signal from the PDW sensors mounted on the front/rear of the vehicle and displays the obstacle location on the SVM Head Unit Screen.
4. Tolerance Compensation (including A/S)
   Manual Tolerance Compensation Software is embedded in the SVMECM to compensate the SVM deviation that may occur due to assembly line installation tolerance. You must first setup proper work environment in order to perform correct tolerance compensation.

Main Features

No	Main Features	Detailed Description	Notes
1	6 View Mode Display	• 3 Front & 3 Rear View Mode Display	Merged Video Display of 8 Modes
2	Front Assist Mode Selection Feature	• Display only the Front Mode by using the Front Mode Selection Switch	Same as the SVM Switch
3	Rear Steering Synchronized Parking Guide Line Display	• Displays Parking Guide Line by synchronizing with the steering wheel when going reverse.	Display over the Rear Video
4	PDW Obstacle Indication	• Display obstacle warning from rear and front PDW sensor	Display both on the Cluster and the Head Unit
5	User Setting Option	• Select Steering Wheel Synchronized Guide Line Indication • Select Front/Rear Obstacle Indication • Select Initial Front/Rear View Screen	Provides additional screen settings
6	Assembly Line & A/S Tolerance Compensation Feature	• Compensation - Tolerance Compensation for camera installation deviation and assembly line tolerance is required	Compensation function recognition logic applied

SVM Mode Entry Conditions

The vehicle information is accessed regularly, even after entering SVM mode. When the conditions are met, conversion from front mode to rear mode is available, and vice versa.

When the mode is converted, the view displayed on the screen can be the initial view or the previous view depending on the conditions.

If the mode for conversion is the initial entry, the default view is selected based on the front or rear. If a continuous front-rear conversion mode occurs as forward and backward movement are repeated for parking, the previous view is recalled and displayed.

– Initial Entry: When the rear and front mode view in SVM mode is displayed on the screen for the first time

– Re-entry: When switching from SVM mode to another mode, without turning off SVM, and returning to the previous mode
(e.g. Rear → Front → Rear: Re-enter rear mode / Front → Rear → Front: Re-enter front mode)

Switch mode	Vehicle speed	Gear	SVM Switch	Display view
Rear → Front	below 15 kph	R Range or P Range excluded	ON	Initial Entry: Front view set in the initial view mode option
				Re-entry: The last view mode displayed in the previous front mode
Front → Rear	Irrelevant	Reverse Gear	Irrelevant	Initial Entry: Rear view set in the initial view mode option
				Re-entry: The last view mode displayed in the previous rear mode

SVM Mode Disengagement

If the conditions below are satisfied while in SVM mode, the SVM is turned OFF and no video is displayed.

OFF Mode	Vehicle speed	Gear	SVM Switch	Notes
Front mode	over 20 kph	R Range or P Range	OFF	If any of the three conditions are satisfied
Rear mode	Irrelevant	Except R gear	Irrelevant	If any of the two conditions are satisfied

SVM Options

Considering the user's convenience, the SVM provides three options for the user to select.

The window for changing options (parking guide settings) is displayed by the AVN. Only the changed options are forwarded to the SVM unit through M_CAN.

These three options are applied as soon as they have been selected by the user. Based on the conditions, the initial views displayed are as follows.

Option	Function	Default setting
Guideline steering interlocking	Interlocks with steering to display the driving direction of the vehicle during parking.	Classification code

Close range warning indicator	Indicates front and rear obstacle detection	Classification code
Initial view mode setting	Default view displayed when entering SVM mode	Front + around view
		Rear + around view

Operations for Guideline Steering Interlocking Indications

The indication for the guideline steering interlocking trace uses the steering wheel angle value periodically received by the SVM unit through C-CAN.
A rear area that displays a 130 degree image of the rear mode (two-split mode) and a wide view are displayed with the expected car movement trace.

1. View modes for guideline steering interlocking indications

Mode	View	Applied area	Notes
Rear	Around view + rear	Rear image (two-split mode)	Click to see large image...
	Left rear + rear	Rear image (two-split mode)	Click to see large image...

	Right rear + rear	Rear image (two-split mode)	Click to see large image...
	Rear wide view	Wide view image	Click to see large image...

2. Specifications for guideline steering interlocking trace lines

Number	Distance	Color
①	0.5 m	Red
②	1 m	Yellow
③	2.3 m	Yellow
④	Bumper left side end + 0.3 m	Yellow
⑤	Bumper right side end + 0.3 m	Yellow

Click to see large image...

3. Indications for neutral trace lines
   If the steering angle is neutral, the neutral trace line is indicated in blue, which shows the expected movement trace of the car.
   This line is displayed with the guideline steering interlocking trace line and is also a fixed line that is not interlocked with the steering angle operation.

SVM System Input/Output

1. Camera input

Item		Specification
Lens angle of view		190 degrees
Angle of view	Horizontal	186 degrees

	Vertical	135 degrees
Function		Provides the original image of the wide angle image (no additional function)
Application location		Same camera applied to the front, rear, left and right

2. SVM image output
   The SVM unit carries out distortion compensation and video merging on the image from 4 cameras installed around the vehicle, indicates steering interlocking guidelines and others, and outputs them in analog.
3. SVM switch
   When the switch is ON, this is used as a control input signal that operates the front view mode.
4. Ignition input
   The SVM unit outputs images only when IGN2 ON. When IGN2 OFF , it is an SVM OFF state, and limits image outputting.
   SVM unit uses signals inputted through IGN pin or M_CAN communication to determine whether IGN2 is ON or OFF.
5. Output switch indicator lamp
   SVM units output power through PWM waves from the LED located in the SVM switch to show the user whether the switch has been pressed.
6. Input chassis CAN (C_CAN)
   The SVM unit uses C_CAN to receive information about the vehicle's condition and to decide whether to carry out main SVM operations.
7. Multimedia CAN input/output (M_CAN)
   M-CAN signal is changed to C-CAN signal by IGPM (routing function or central gateway) and then SVM unit can use this C-CAN signal.
   M_CAN to communicate with IGPM to send and receive the following information.
   – Send SVM mode conversion requests for SVM output images (e.g. Navi mode→SVM mode)
   – Send requests for user SVM view conversion
   – Send compensation coordinates for tolerance compensation
   – Send warning messages to be indicated in the AVN
   – Send any user option changes

- Inspection

Tolerance Compensation

Tolerance compensation compensates for the error margins of around view video that occur due to the installation tolerance when the four cameras that comprise the SVM system are installed.
You must carry out tolerance compensation if you do any of the following.

– Remove and install a wide camera.
– Conduct a body task that causes the focus of the wide camera to change, such as a trunk task.
– Replace the door mirror that has a wide camera.
– Replace the around view monitoring unit.

Tolerance Compensation Environments

Click to see large image...

NOTICE

There are two types of tolerance compensation [manual tolerance compenstation] and [automatic tolerance compensation].
The service center with the SVM exclusive workshop performs [automatic tolerance compensation].
The maintenance environment lacking an SVM exclusive workshop performs [manual tolerance compensation].

The Procedure of Manual Tolerance Compensation

1. Advanced preparations will be made according to the following.
   – Confirm that the car hood, trunk and door are closed.
   – The door is closed after getting in on the passenger side.

- Unfold the side mirror if it is folded in.
- Put the gear into neutral.
- Confirm that LED turning signals are lighting up within the switch.
- In the preparation stage ahead of time an exhaust inhaler should not be installed as it can block the view of the rear camera.
- Also, the exhaust from the exhaust pipe can create a smokescreen blocking rear footage, therefore after using a fan to clear the exhaust the compensation work should be performed while in IGN (ignition).
- The foot brake or electro-mechanical parking brake should be engaged to prevent the car from moving.

2. The following processes will be performed to confirm whether or not the SVM ECU and camera are working properly before engaging tolerance compensation mode.
   - Confirm that the initially set up video is showing up. (front view footage while the gear is in neutral + around view footage)
   - Confirm that footage from the front, back, left and right is showing up properly.
   - When the footage appears properly, the tolerance compensation mode will be engaged, and when footage is not showing up clearly or does not show up at all the part will have to be replaced.
3. Install around the vehicle by referring to the guide that was provided along with the compensation scales (2), compensation standard line boards (2), and compensation target boards (4).

⚠ CAUTION

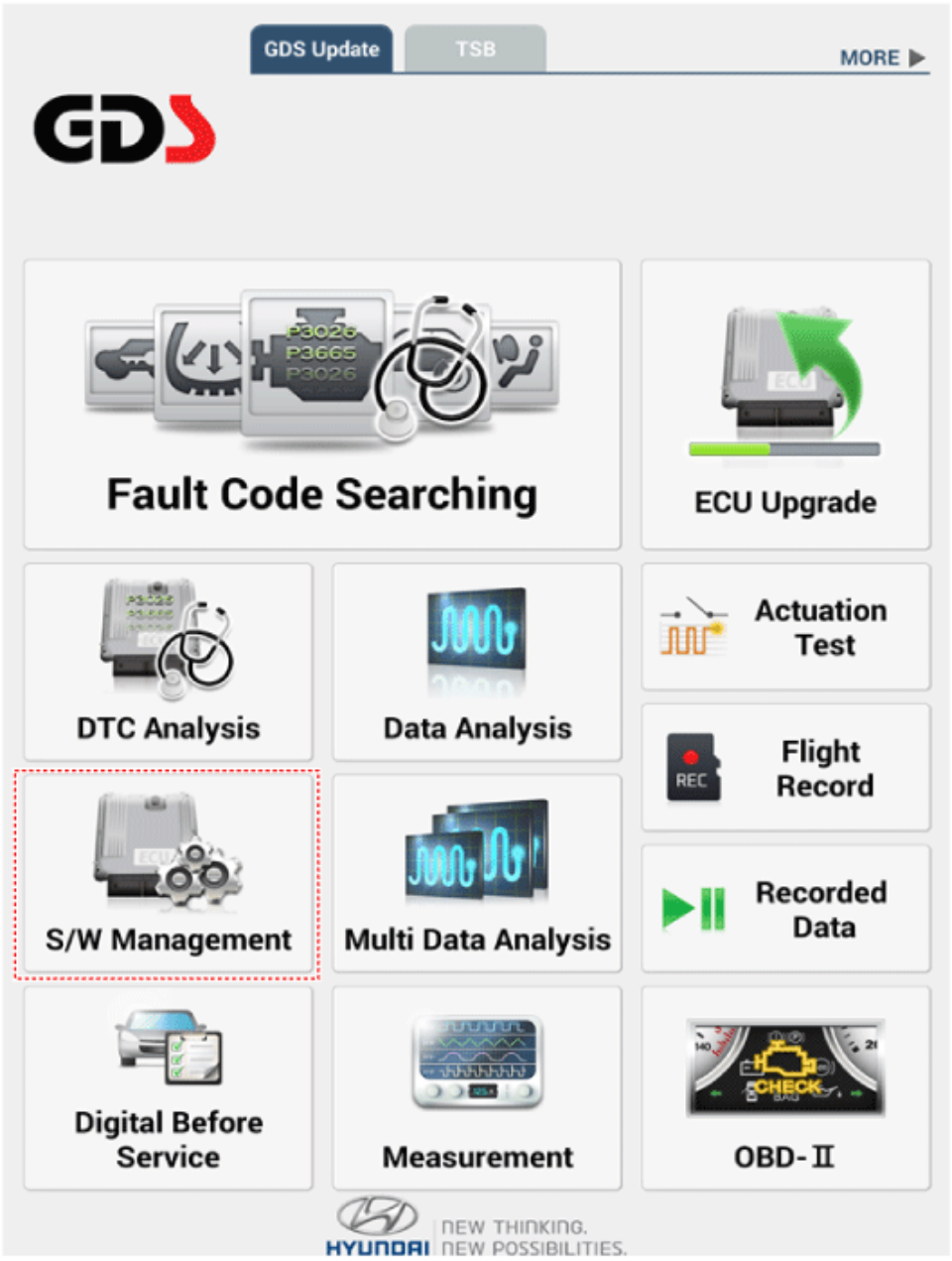
When centering the wheels on the compensation standards line board, the A-type and B-type must be centered separately.

Caution should be taken because the center location of the white and black compensation plate consist of standard coordinates the accuracy(distance / right-angles) are very important.

- The front and rear / left and right centering should be maintained within a deviation of 3cm.
- When centering the vehicle the rotation deviation should be maintained within 1 degree on the side.

Click to see large image...

4. Keep the IG on while the car is stopped, confirm the location of the gear stick is on ‘N’ and engage the parking brake on a flat area.
5. Perform the work with the SVM switch in the vehicle set to ‘ON.’
6. Perform SVM Calibration according to Diagnostic tool diagnostics display.


GDS Update
TSB
MORE ▶
GDS
P3026
P3665
P3026
Fault Code Searching
ECU Upgrade
DTC Analysis
Data Analysis
Actuation Test
REC
Flight Record
S/W Management
Multi Data Analysis
Recorded Data
Digital Before Service
Measurement
CHECK
OBD-Ⅱ
HYUNDAI
NEW THINKING. NEW POSSIBILITIES.

Click to see large image...

7. Proceed with the AVM calibration according to the Diagnostic tool screen.

Click to see large image...

Click to see large image...

⚠ CAUTION

- Before matching the calibration point : "+" blinks in green color.
- When you click [OK] after matching the calibration point : "+" turns on in red color.
- After matching 4 forward correction points, click [OK] button and click [Update AVM] button to move to the next camera calibration.
- Perform the calibration in the order of front -> rear -> left -> right camera.

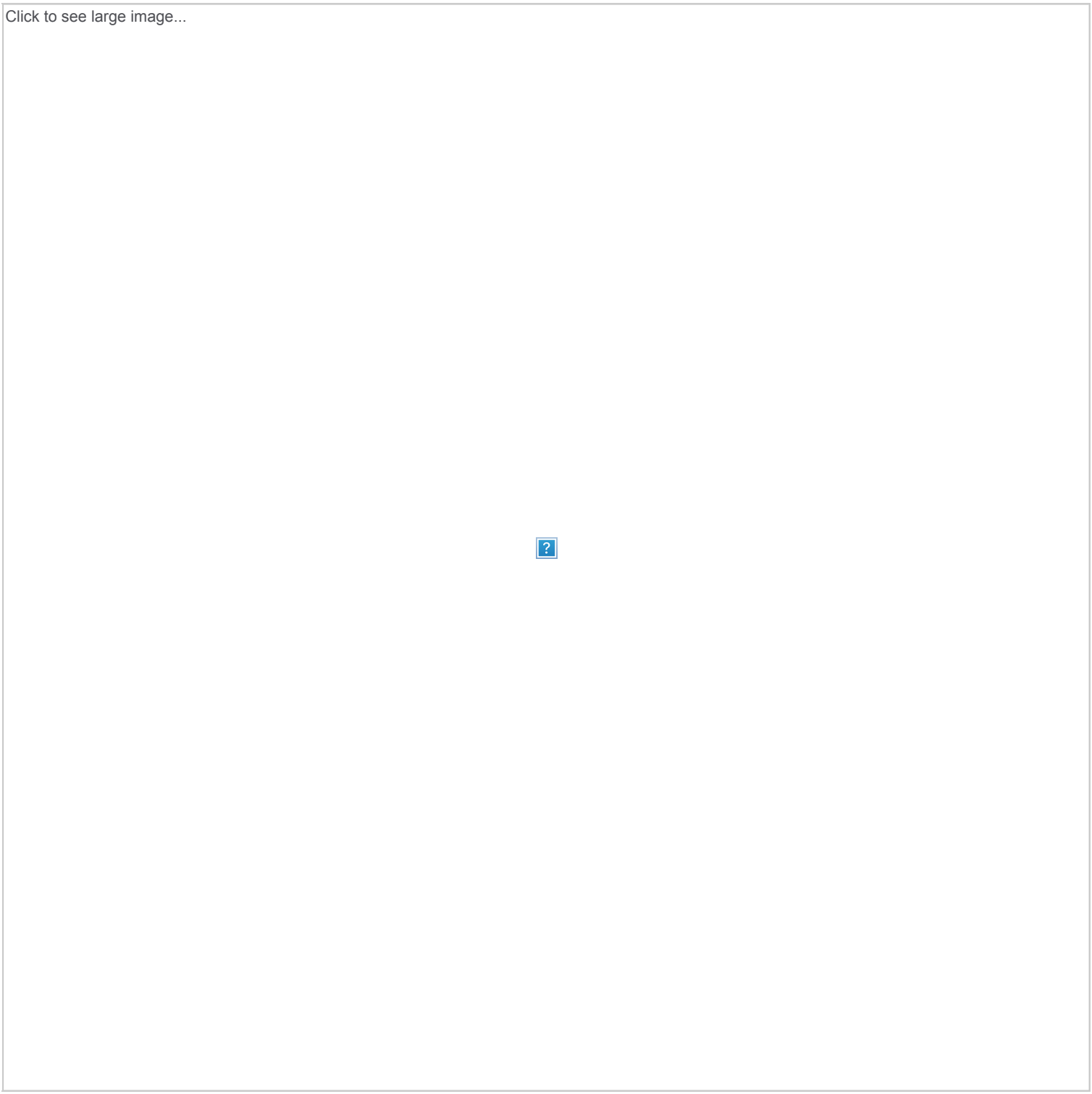
Click to see large image...

Click to see large image...

8. After checking the vehicle and calibration line on the AVN monitor screen to see if the calibration has been performed properly, press the [OK] button. When calibration has not been performed properly, press the [Cancel] button to match the calibration points again.

[AVN Monitor]

Click to see large image...



[Diagnostic tool Screen]

Click to see large image...

- Components

SVM Unit

Click to see large image...

No	Connector A
1	ACC
2	LED
3	EXT Ground
4	Y Shield
5	-
6	C-CAN Low
7	Y Video ground
8	-
9	-

10	Rear camera power
11	Left camera power
12	Right camera power
13	Ignition
14	AVM switch
15	-
16	C Shield
17	-
18	C- CAN High
19	C video ground
20	C video output
21	-
22	-
23	Left camera ground
24	Right camera ground

Click to see large image...

- Removal

1. Disconnect the negative (-) battery terminal.
2. Remove the carash pad lower panel.
   (Refer to Body - "Crash Pad Lower Panel")
3. Disconnect the SVM unit connector.

Click to see large image...

4. Remove the SVM unit after loosening the mounting bolts and screw.

Click to see large image...

- Installation

1. Install the SVM unit.
2. Install the glove box housing and glove box.
3. Connect the negative (-) battery terminal.

- Components

[Ultra Optical Camera - RH/LH]

Click to see large image...

[Ultra Optical Camera - Front]

Click to see large image...

[Ultra Optical Camera - Rear]

Click to see large image...

- Removal

Information

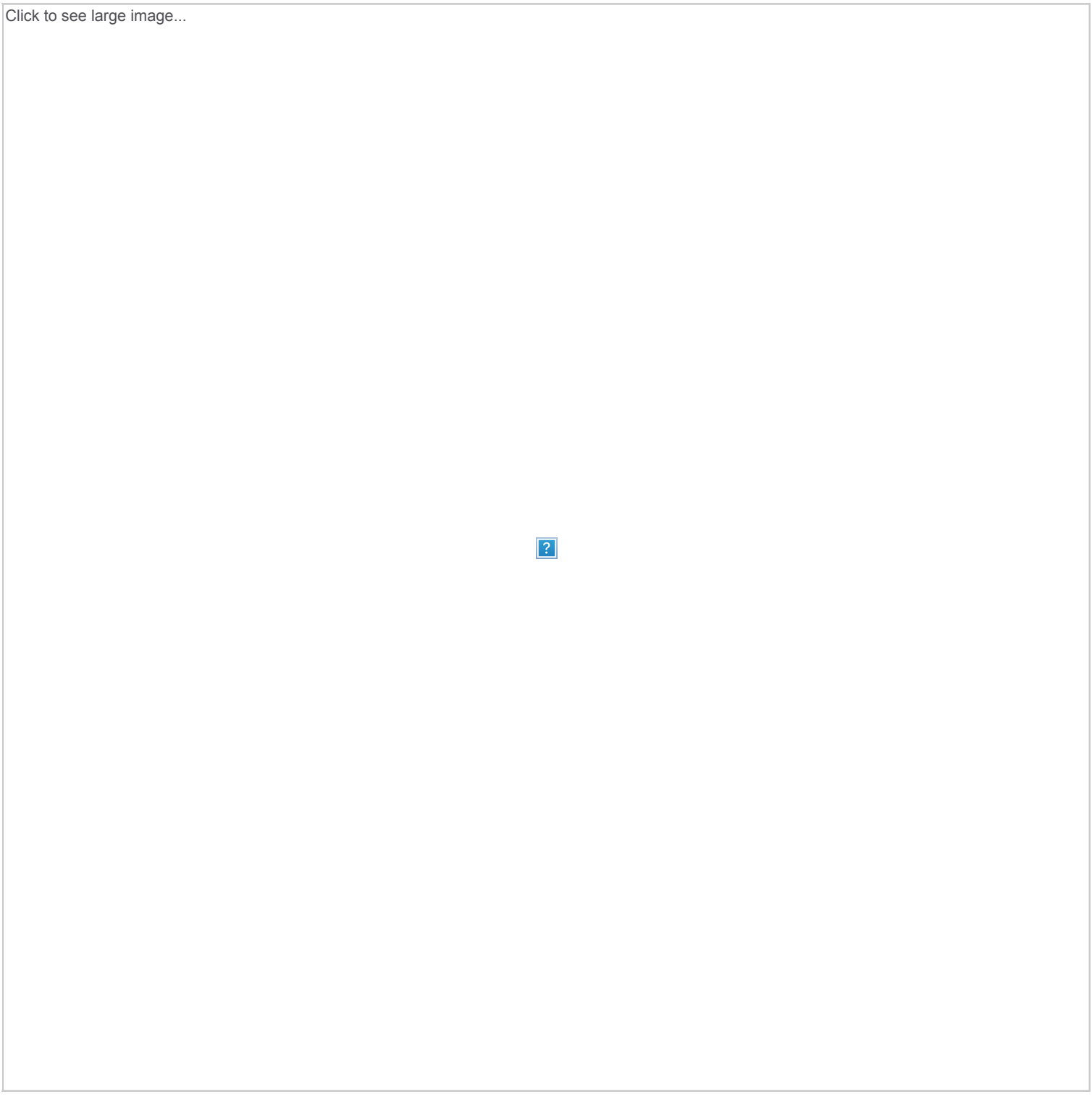
- In case of bad quality or poor focus, be sure to check the camera lense surface condition and foreign materials.

Front Camera

1. Disconnect the negative (-) battery terminal.

2. Remove the front bumper cover.
   (Refer to Body - "Front Bumper Cover")
3. Remove the pantocscpic camera after loosening the mounting screws and connector.

Click to see large image...

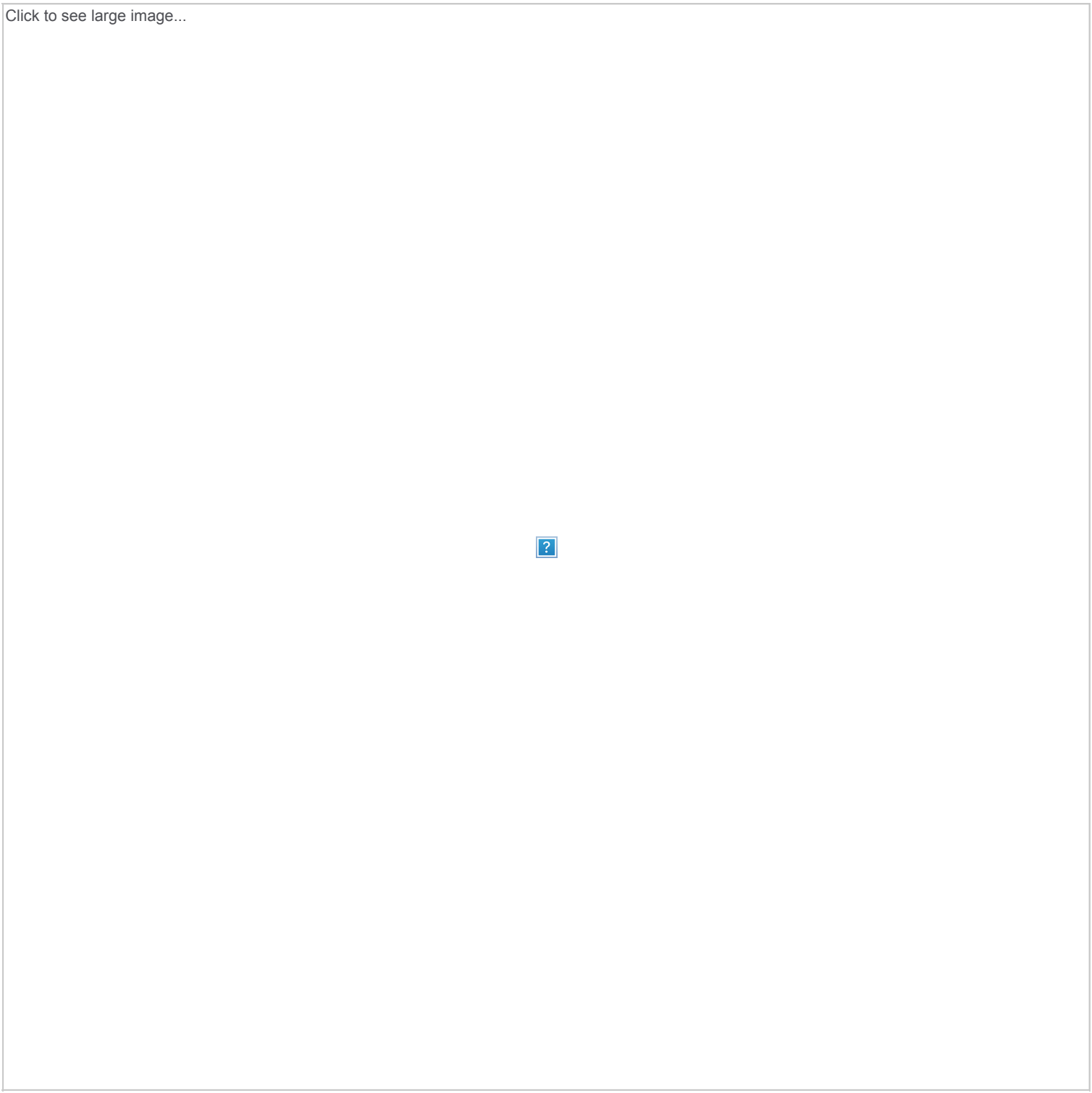


Rear Camera

1. Disconnect the negative (-) battery terminal.
2. Remove the tailgate trim.
   (Refer to Body - "Tailgate Trim")
3. Remove the tailgate back panel.
   (Refer to Body - "Tailgate Back Panel")

4. Disconnector the connector (A) and then remove the rear view camera.

Click to see large image...



Left/ Right Camera

1. Disconnect the negative (-) battery terminal.
2. Remove the mirror.
   (Refer to Power Door Mirror - "Power Door Mirror Actuator")

- Installation

Front Camera

1. Install the front camera.
2. Install the front bumper cover.

Rear Camera

1. Install the rear camera.
2. Install the tailgate back panel.
   (Refer to Body - "Tailgate Back Panel")
3. Install the tail gate trim.
   (Refer to Body - "Tail Gate Trim")

Left/Right Camera

1. Install the door mirror.

- Removal

Floor Console Switch

1. Disconnect the negative (-) battery terminal.
2. Remove the floor console upper cover.
   (Refer to Body - "Floor Console Assembly")
3. Remove the SVM switch after loosening the mounting screws.

Click to see large image...

- Installation

Floor Console Switch

1. Install the SVM switch.
2. Install the console upper cover.

- Troubleshooting

⚠ CAUTION

1) After replacing SVM unit, always check that the system operates properly.
2) If the failure persists after replacing the SVM unit, do not replace the unit.

1. Inspection by DTC Code

Symptom	Probable Cause	Remedy
1. Single DTC code appearance	Loose connector relevant to a certain DTC code	1) Check connection status and reconnect the connector.
	Tolerance compensation not completed	1) DTC code appearance (B103000) 2) Perform tolerance compensation.
	Disconnected wiring	1) Inspect for conductivity of relevant area of DTC and wiring. - (B280000/C161600/B162C00)
	Faulty wiring connector	1) Check for bent or damaged wiring connector pin. 2) Inspect wiring.
	Faulty SVM unit connector	1) Check for bent or damaged SVM unit connector pin. 2) Replace SVM.
	Faulty SVM single unit	1) Check basic operation and DTC on Diagnostic tool. 2) Replace SVM.
2. Multiple DTC codes appearance	Loose SVM main connector	1) Check connection status and reconnect the connector.
	Disconnected wiring	1) Camera power - In case of 6V or below, inspect relevant wiring. 2) ACC/IGN power - In case of 7.5V or below, inspect relevant wiring. 3) SVM switch - In case of 1.75V or higher with the switch ON, inspect relevant wiring.
	Faulty wiring connector	1) Check for bent wiring connector pin or interference in neighboring parts. 2) Inspect wiring.
	Faulty SVM unit connector	1) Check for bent SVM unit connector or interference in neighboring parts. 2) Replace SVM.
	Faulty SVM single unit	1) If failure recurs after the items above are confirmed normal, replace SVM.

2. Inspection for Defect in SVM Performance (Image Output)

Symptom	Probable Cause	Remedy
1. No image output : Black screen, Blue screen	Loose SVM main connector	1) Check connection status and reconnect the connector.
	Disconnected SVM wiring	1) Inspect for conductivity of ACC / IGN / V-OUT / M-CAN terminal wiring
	Faulty IPM (SJB)	1) Check power of ACC / IGN terminals : In case of 7.5V or below, inspect IPM (SJB)
	Faulty SVM	1) If failure recurs after the items above are confirmed normal, replace SVM.
2. Abnormal image output :Noise on screen / lines / cracked display / unable to change display	Loose main connector	1) Check connection status and reconnect the connector.
	Disconnected or short-circuited wiring	1) Inspect the wiring relevant to DTC appearance.
	Faulty tolerance compensation	1) If the SVM image display is cracked even though the camera display is normal, execute tolerance compensation again.
	Faulty camera	1) If both camera display and SVM image display are cracked, inspect the camera.
	Faulty IPM (SJB)	1) In case of DTC code (C161600) appearance, inspect IPM (SJB).
	Faulty console switch	1) Inspect SVM switch. - In case of 1.75V or higher with the switch ON, replace the switch.
	Faulty SVM	1) If failure recurs after the items above are confirmed normal, replace SVM.

3. Inspection for Faulty PAS Warning Display & Parking Guideline

Symptom	Probable Cause	Remedy
1. Faulty PAS warning display & faulty parking guideline	AVN option information not configured	1) Check and modify AVN option configuration status.
	Loose main connector	1) Check connection status and reconnect the connector.
	Faulty IPM (SJB)	1) Check that Parking Assist System (PAS) and Steering wheel Angle Sensor (SAS) are normal. 2) Inspect IPM (SJB).

	Faulty SVM	1) If failure recurs after the items above are confirmed normal, replace SVM.

- Specifications

Item	Specification
Rated voltage	DC 12V
Operating voltage	DC 8.5 - 16V
Operating temperature	-86 to 167°F (-30 to 75°C)
Dark current	MAX 1mA
Output power	5 W
Output frequency	110 ± 5 kHz

- Components

Click to see large image...

1. Wireless power charging unit
2. Wireless power charging lamp

- Description and Operation

Wireless Power Charger System

During ACC or IG ON, battery voltage is supplied to the wireless power charger system to transmit an output of 5 W to mobile phone.
Mobile phones certified with the wireless charging standard WPC (Qi 1.1.2) or equipped with an exclusive wireless charging case can be used.

Information

- WPC : Wireless Power Consortium
- Qi 1.1.2 : refers to certified product with the capability to transmit power of up to 5 W and detect metal and other impurities to prevent heating.

Click to see large image...

1. Power receiver : embedded with the secondary coil designed to receive the induced current from the charging pad.
2. Charging pad : electrical coils wound inside the plastic cover.
3. Coil : Rectangular and circular coils generate diverse electromagnetic fields.
   A. Connect power to the charging pad to generate electromagnetic fields in the coil.
   B. Current induced from electromagnetic induction phenomenon is sent to the power receiver to charge the battery.

System Configuration Diagram

Click to see large image...

1. Instrument cluster : Alerts about contact with mobile phone
2. BCM unit : Determines contact with mobile phone
3. Wireless charging lamp : Displays the charging status
4. SMK unit : Stops charging during the activation of LF

Major Functions of Wireless Power Charger System

1. Charging Function

(1) Activation method

a. Close all doors of the car.

b. Switch vehicle power to ACC or IG ON.

c. Place the wireless charging-enabled mobile phone on the tray.

(2) Charging status display

Mode	Charging LED display		Remarks
Stand by for charging	LED turned OFF	Click to see large image...	
Charging in process	Amber LED turned ON	Click to see large image...	
Charging completed	Green LED turned ON	Click to see large image...	
Charging error	Amber LED blinks	Click to see large image...	– Blinks 10 times for 10 seconds, then LED is turned off for 50 seconds (total 60 seconds)

2. Alert for contact with mobile phone

(1) Activation method

a. Key OFF while the mobile phone is being charged.

b. Checks if the mobile phone is placed on the wireless charging unit.

c. Alert message for contact with mobile phone is displayed on the instrument panel (for about 4 - 5 seconds).

Click to see large image...

3. Overheating prevention

(1) Activation method

a. If the thermistor temperature inside the wireless charging module rises above a certain level (158 °F (70 °C)), charging will stop to protect the mobile phone battery.

Information

- The amber LED of the charging display lamp blinks 10 times for 10 seconds, and then it is turned off for 50 seconds (total 60 seconds).
- The process is repeated for every 60 seconds.

b. If the thermistor temperature falls below a certain level (149 °F (65 °C)), charging will restart.

> **Information**
> When the charging function is restarted, the amber LED of the charging display lamp will be turned on.

4. Foreign matter detection
   (1) Charging will be stopped if there is a coin or other metallic object between the wireless charging unit and the mobile phone.

[Foreign matter]

Click to see large image...

> **Information**
> • Foreign matter : All metallic objects such as coins, clips, and precious metals

- The amber LED of the charging display lamp blinks 10 times for 10 seconds, and then it is turned off for 50 seconds (total 60 seconds).
- The process is repeated for every 60 seconds.

⚠ CAUTION

Be careful as touching the foreign matter by hand may cause burns.

(2) After the system has detected foreign matter and stopped charging the mobile phone, the charging will resume in about 60 seconds once the foreign matter has been removed.

Information

When the charging function is restarted, the amber LED of the charging display lamp will be turned on.

5. SMK unit LF frequency interference prevention

This function prevents interference between the wireless charging frequency and smart key unit frequency band.

(1) Wireless charging is stopped when the door is open or the SMK unit is in LF mode (searching for smart key).

e.g. Wireless charging function is stopped if the driver carries the smart key out of the vehicle during IG ON.

Click to see large image...

Information

Charging will stop and the amber LED of the charging display lamp will turn off.

(2) It will return to normal operating status when the LF mode of the SMK unit is completed.

6. Turn the wireless charging function ON/OFF with USM.

Click to see large image...

※ Tailgate applies to RV vehicle models.

Protection of Wireless Power Charger System

Item	Condition	Status
Protects against low/high voltage	Protects and stops charging under 7.0 V and over 16.5 V	LED OFF (Stops operation)
	Charges over 7.5 V and under 16.0 V	
Protects against reverse voltage	Protects and stops charging in case of reverse voltage	LED OFF (Stops operation)
Protects against overcurrent	Protects and stops charging in case of detecting 4.5 A	Amber LED blinks
Protects against overheating	Protects and stops charging in case of detecting 158°F (70°C) by internal temperature sensor of wireless charging module	Amber LED blinks

	Resumes under 149°F (65°C)	
Foreign matter (Coins, clips, precious metals, etc.)	Protects and stops charging in case of detecting foreign matter (overheating prevention)	Amber LED blinks
Prevents frequency interference	Protects and stops charging by activating SMK in case door or tailgate is open	LED OFF (Stops operation)
	Resumes in 3.5 seconds after all doors and tailgate are closed and SMK operation is completed	
Alert for contact with mobile phone	During key-off with contact with mobile phone	Displays warning message on the instrument panel (for about 4-5 seconds)

※ Tailgate applies to RV vehicle models.

- Components

Click to see large image...

- Circuit Diagram

Click to see large image...

- Removal

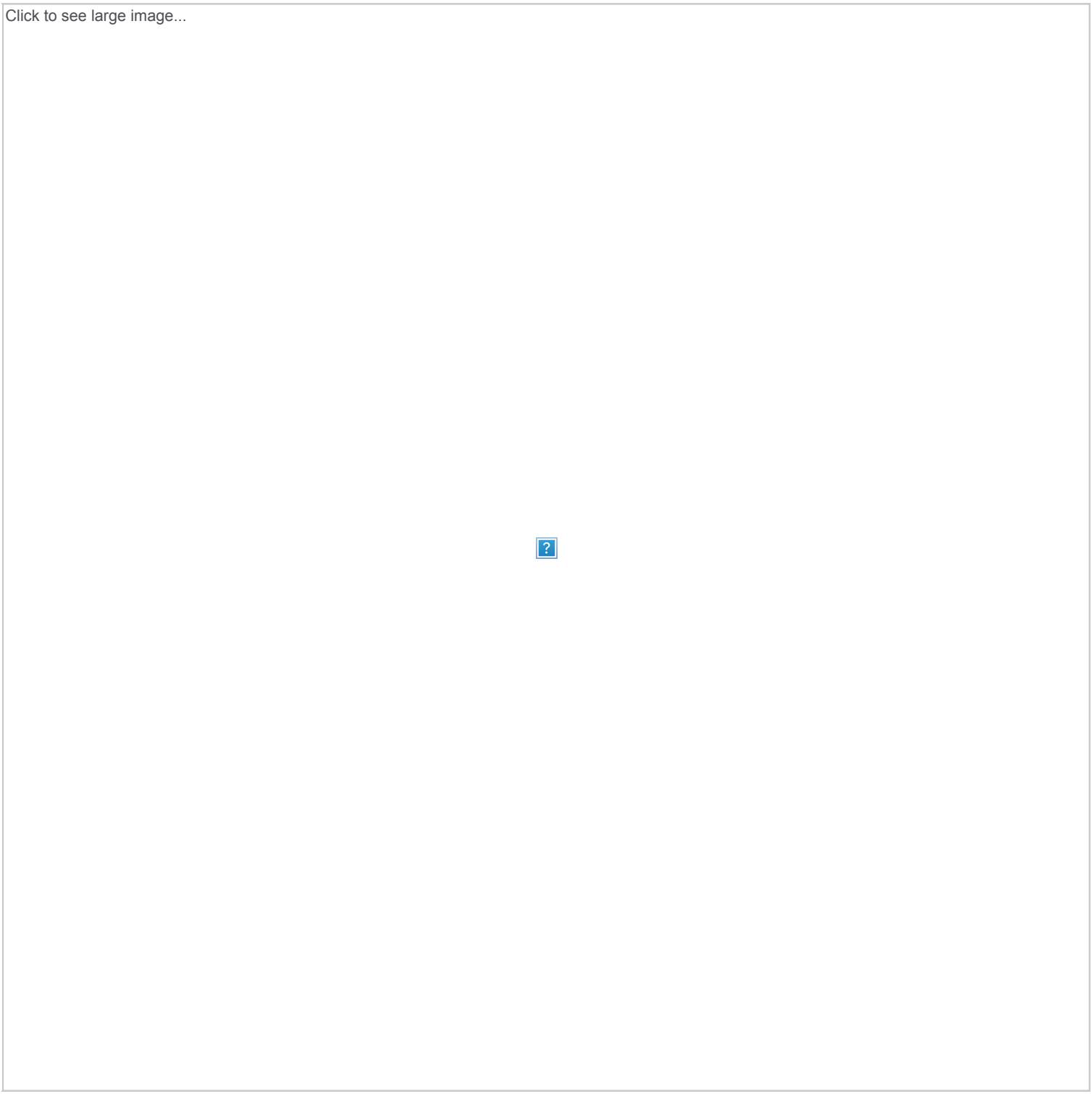
⚠ CAUTION

Handling wireless charging system parts by wet hands may cause electric shock.

1. Disconnect the negative (-) battery terminal.
2. Remove the floor console cover assembly.
   (Refer to Body - "Floor Console Assembly")

3. Remove the floor console tray (A) after removing the screws.

Click to see large image...



4. Disconnect the wireless power charging unit connector (A).

Click to see large image...

5. Remove the wireless power charging unit.

Click to see large image...

- Installation

1. Connect the wireless power charging unit connectors.
2. Install the wireless power charging unit.
3. Install the floor console assembly.
4. Connect the negative (-) battery terminal.

- [Diagnosis With KDS/Diagnostic tool]

1. In the body electrical system, failure can be quickly diagnosed by using the vehicle diagnostic system (Diagnostic tool).
   The diagnostic system(Diagnostic tool) provides the following information.

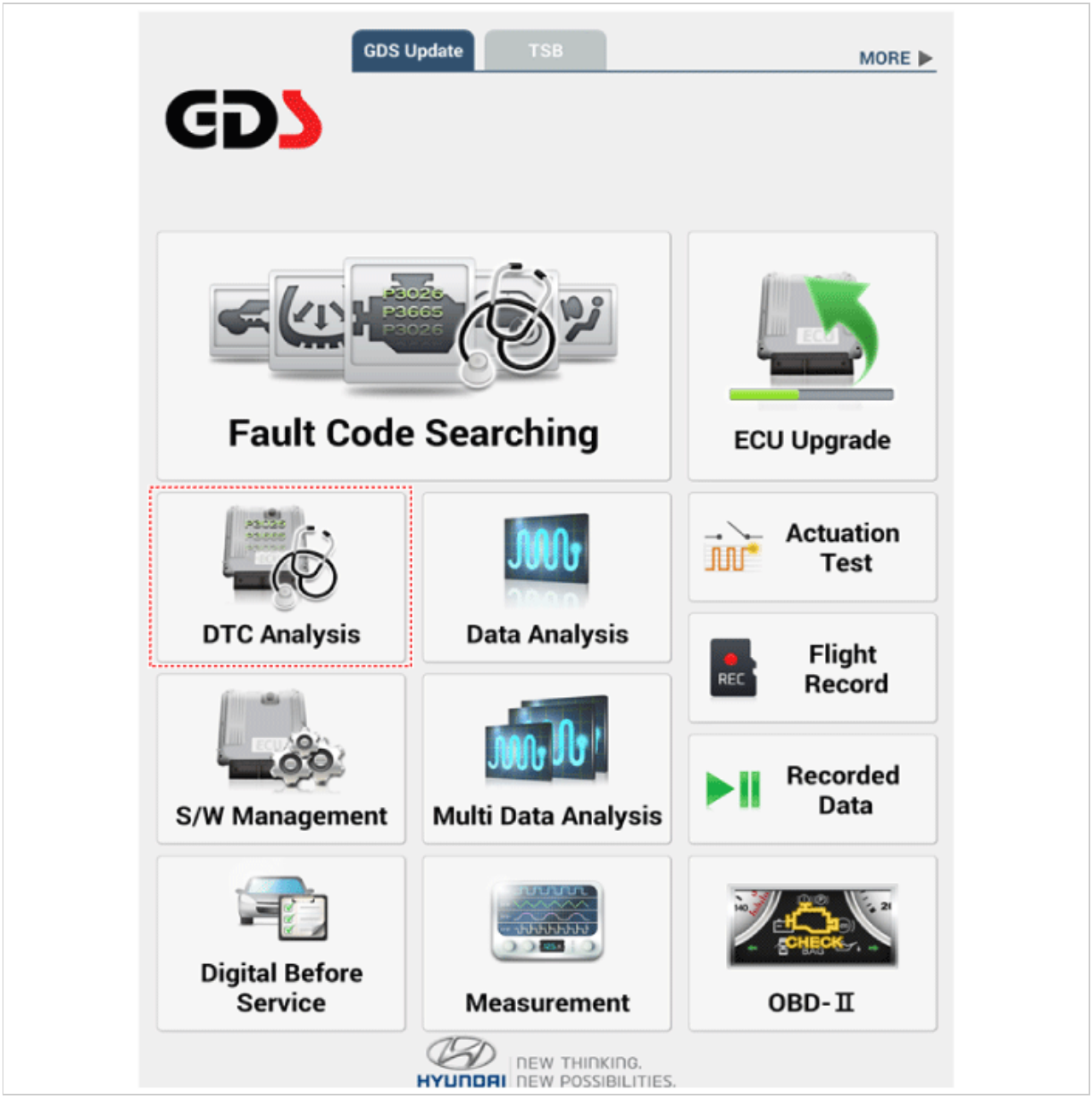
(1) Fault Code Searching : Checking failure and code number (DTC)

(2) Data Analysis : Checking the system input/output data state

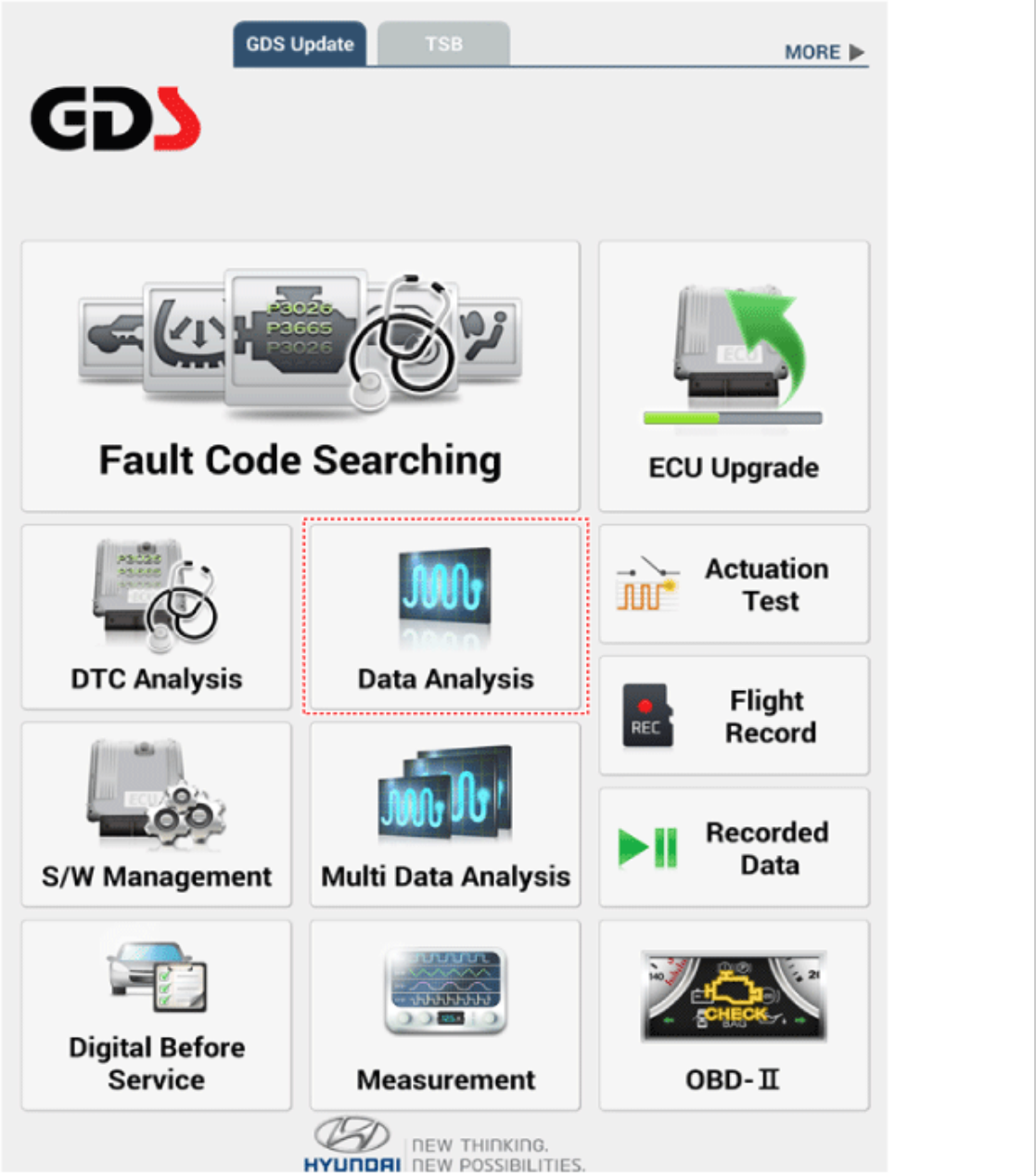
(3) Actuation test : Checking the system operation condition

(4) S/W Management : Controlling other features including system option setting and zero point adjustment

2. If diagnose the vehicle by Diagnostic tool, select "DTC Analysis" and "Vehicle".



3. If check current status, select the "Data Analysis" .



4. Select the 'WPC' to search the current state of the input/output data.

Click to see large image...

Click to see large image...

5. To forcibly actuate the input value of the module to be checked, select option 'Actuation Test'.

Click to see large image...

- Components

Click to see large image...

- Removal

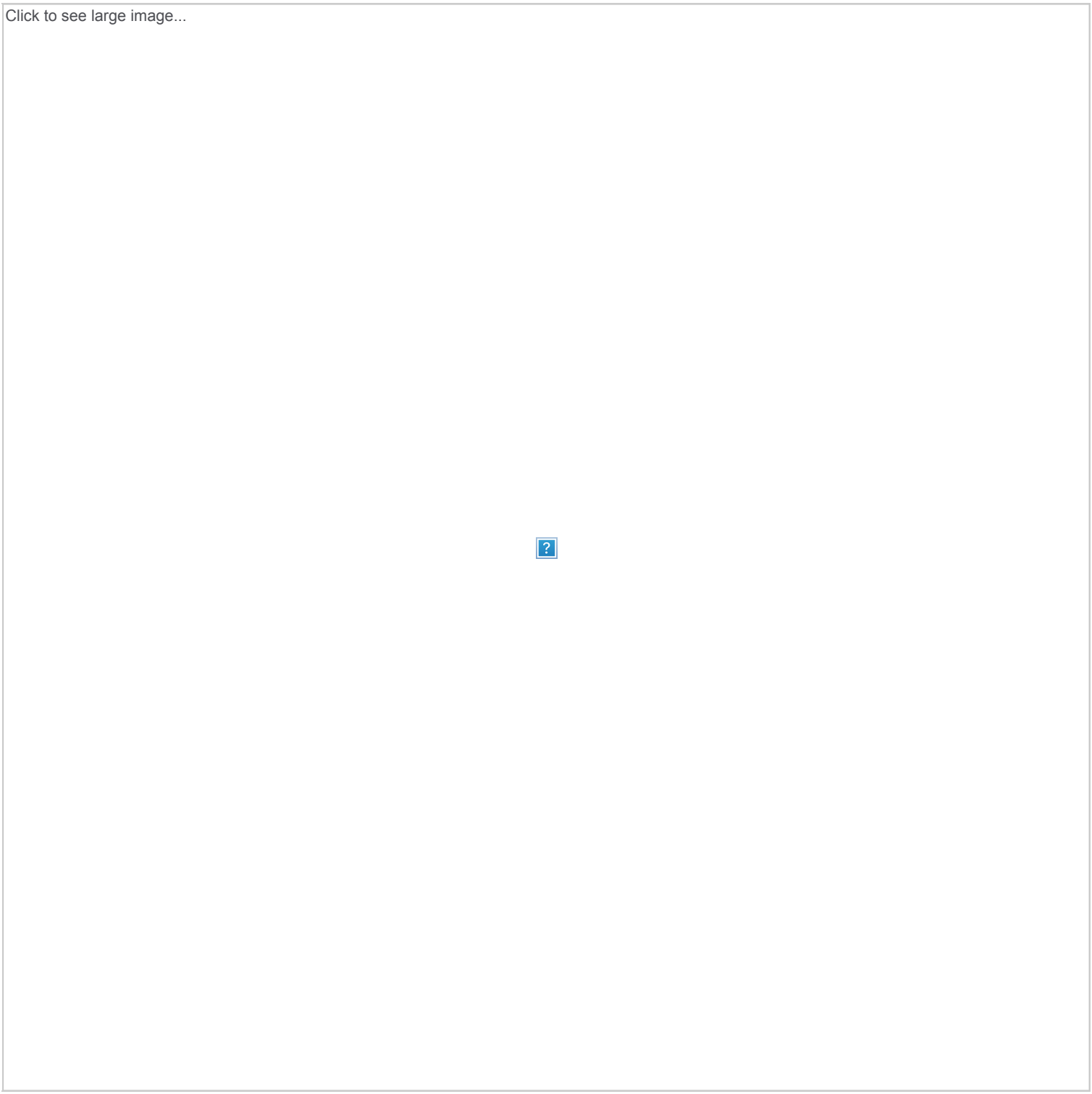
⚠ CAUTION

Handling wireless charging system parts by wet hands may cause electric shock.

1. Disconnect the negative (-) battery terminal.
2. Remove the floor console upper cover assembly.
   (Refer to Body - "Floor Console Assembly")

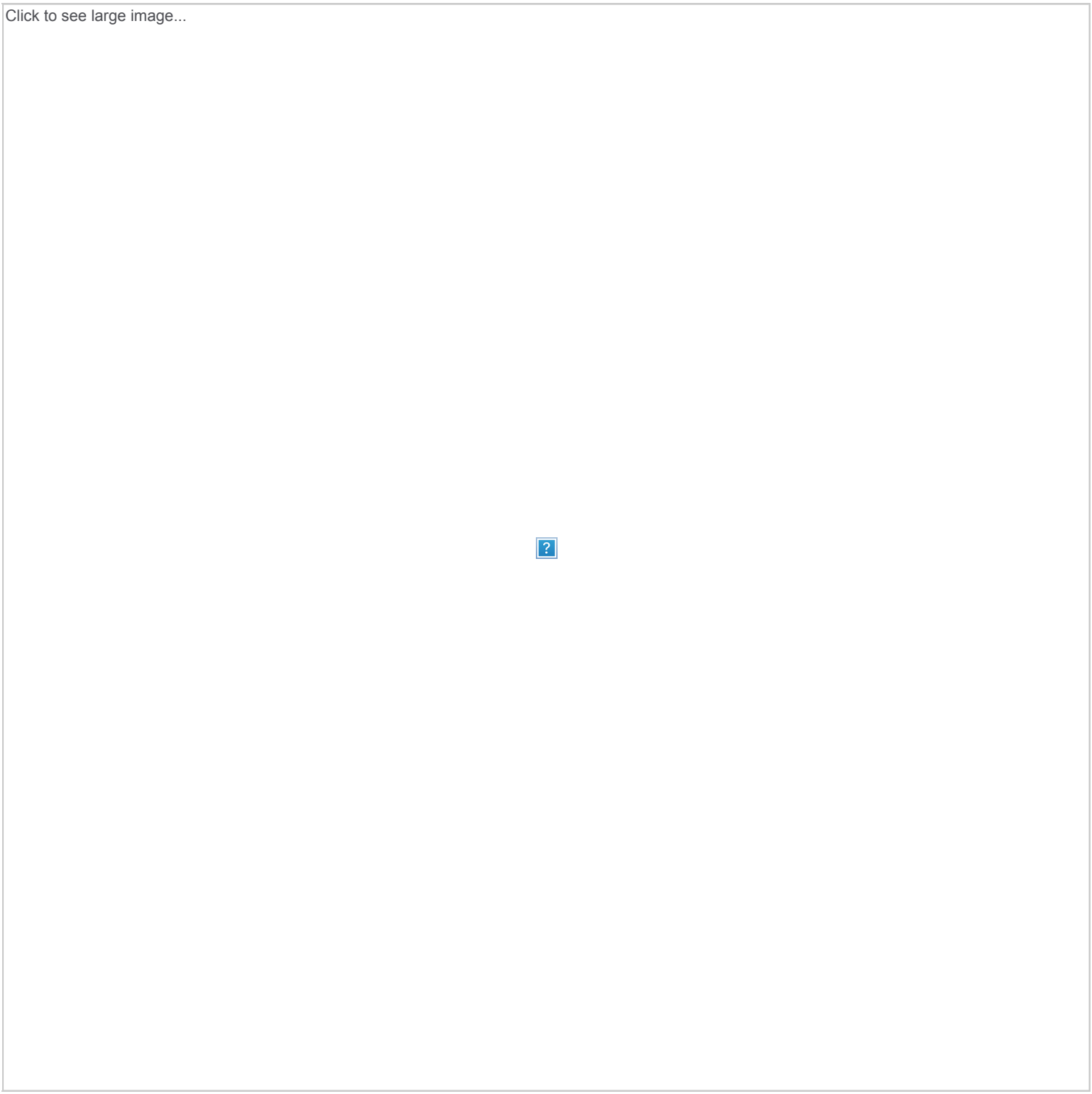
3. Remove the floor console tray (A) after removing the screws.

Click to see large image...



4. Disconnect the wireless charging lamp connector (A).

Click to see large image...



5. Disengage a fixed hook and then remove the wireless charging lamp.

Click to see large image...

- Installation

1. Install the wireless charging lamp.
2. Connect the wireless charging lamp connector.
3. Install the floor console upper cover assembly.
4. Connect the negative (-) battery terminal.

- Troubleshooting

Wireless Power Charger System Troubleshooting

Trouble status	Inspection item	Inspection
Not charged	Check the mobile phone status	R-1
Amber LED blinks	Overcurrent	R-2
	Overheating	R-2
	Foreign matter	R-2

R-1. Check the wireless power charger system operation

1. If the placement of a mobile phone is not detected
   (1) If the internal temperature of the mobile phone battery is high, the mobile phone itself turns "OFF" the power.

   Information
   The temperature at which the power is automatically turned "OFF" differs by mobile phone model.

   (2) If the mobile phone was placed outside the charging range

   (3) If the mobile phone was placed by its LCD side on the charging pad surface (if the phone was placed upside down)

   (4) If the mobile phone was turned 180˚

2. Check that the amber LED of the wireless charging lamp turns on when the mobile phone is in normal condition and is correctly placed.

R-2. Check for overcurrent, overheating and foreign matter

1. Overcurrent : Charging stops in overcurrent of over 4.5 A
   (1) The overcurrent error status will be reset when the current falls under 4.5 A or when ACC is turned off and on.

2. Overheating : The unit will be automatically turned "OFF" when the internal temperature of the wireless charging unit is over 158°F (70˚C).
   (1) The error status will be reset when the internal temperature of the wirelss charging unit falls under 149°F (65°C).

3. Foreign matter : When metallic objects such as coins, clips and precious metals are detected, charging will be stopped to prevent overheating.
   (1) Error status will be reset when foreign matter is removed.

Information
- The amber LED of the charging display lamp blinks 10 times for 10 seconds, and then it is turned off for 50 seconds (total 60 seconds).
- The process is repeated for every 60 seconds.
- Turning ACC OFF/ON resets the error status and returns to normal operation.

- Specifications

Items	Blind-Spot Collision Warning (BCW)	Blind-Spot Collision- Avoidance Assist-Rear (BCA-R)
Rated voltage	DC 12V	
Operating voltage	9V - 16V	
Operating speed	30 km/h - 255 km/h	60 km/h - 180 km/h
Sensible distance	70m	
Curvature radius	Start : More than 100m	Start : More than 625m
	Stop : Less than 70m	Stop : Less than 588m
Frequency	24 GHz	
Numbers	2EA	

Items	Rear Cross-Traffic Collision Warning (RCCW)	Rear Cross-Traffic Collision- Avoidance Assist (RCCA)
Rated voltage	DC 12V	
Operating voltage	9V - 16V	
Operating speed	0 km/h - 10 km/h	1 km/h - 10 km/h
Sensible distance	25m	

Curvature radius	-
Frequency	24 GHz
Numbers	2EA

- Components

Click to see large image...

1. Rear Corner Radar unit
2. Rear Corner Radar switch
3. Speaker (Cluster)
4. Blind-Spot Radar warning indicator

- Description

Click to see large image...

Blind-Spot Radar is a system that measures the relative speed and distance from the following vehicles by using two electromagnetic wave radar sensors attached to the rear bumper, and detects any vehicle within the blind spot zone and gives off alarm (visual and auditory).

- Blind-Spot Collision Warning (BCW) : Senses other vehicles in the BCW zone and turns on the BCW warning lamp for the driver. Warning lamp starts blinking when the driver turns on the turn signal lamp to enter the lane where another vehicle is driving.
- RCCW (Rear Cross-Traffic Collision Warning) : When the vehicle is on the reverse, the RCCW generates alarm to alert another vehicle approaching from the rear and side.
- RCCA (Rear Cross-Traffic Collision-Avoidance Assist) : When the vehicle is on the reverse, the RCCA take brake to avoid another vehicle approaching from the rear and side.

– BCA-R(Blind-Spot Collision-Avoidance Assist - Rear) : When the lane departure, BCA-R generates avoidance for another vehicle within the blind spot zone.
– SEA (Safe Exit Assist) : When getting off the vehicle, SEA generates alarm to alert another vehicle approaching from the rear.

System Operating Mode

Click to see large image...

1. When starting the engine with the switch off, OFF mode is on.
2. When pressing ON switch in OFF mode, Passive mode is on.
3. If starting the engine with the switch ON, Passive mode is on.
   ※ When IGN is ON, the switch is in the initial state : The last position is kept.
   – If IGN OFF → ON with the switch ON, the switch is ON.

– If IGN OFF → ON with the switch OFF, the switch is OFF.

4. If you start the engine with Blind-Spot switch ON, or if you turn on Blind-Spot Radar with Blind-Spot switch OFF, the warning lamp of the door mirror flickers for 2 to 3 seconds.
   This is to inform the driver that the Blind-Spot Radar system is ready. (provided that if the system is in Fail mode, there is no flickering.)
5. If the activation conditions (speed and curvature radius) are met while driving, Active mode is on (warning issued).
6. If the activation conditions (speed and curvature radius) are not met while driving, Passive mode is on (warning removed).
7. If BCW & LCA operation fails in any mode, Fail mode is on.
8. If BCW & LCA operation operates normally in Fail mode, OFF mode is on.
9. If pressing OFF switch while BCW & LCA function is operating (Active/Passive), OFF mode is on.

Warning Condition

1. Warning zone

Click to see large image...

2. Conditions for BCW warning ON

① The entire body of the target vehicle is located behind the line A.

② Any part of the target vehicle pass the line B.

③ Any part of the target vehicle passes the line D and Hysteresis In.

④ The entire part of the target vehicle passes the line E and Hysteresis In.

Click to see large image...

3. Conditions for BCW warning OFF

① The entire body of the target vehicle moves before the line A.

② The entire body of the target vehicle moves behind the line B.

③ The entire body of the target vehicle passes the line D and Hysteresis Out.

④ The entire part of the target vehicle passes the line E and Hysteresis Out.

Click to see large image...

4. Conditions for LCA warning ON

① The entire body of the target vehicle is located behind the line B.

② Any part of the target vehicle pass the line C.

③ Any part of the target vehicle passes the line D and Hysteresis In.

④ The entire part of the target vehicle passes the line E and Hysteresis In.

⑤ In the all above condition, TTC(Time to Collision) is not less than 4.5 sec.

Click to see large image...

5. Conditions for LCA warning OFF

① The entire body of the target vehicle is located before the line B.

② The entire body of the target vehicle pass the line C.

③ The entire body of the target vehicle passes the line D and Hysteresis Out.

④ The entire body of the target vehicle passes the line E and Hysteresis Out.

⑤ In the all above condition, TTC(Time to Collision) is more than 4.5 sec.

Click to see large image...

6. Sensor activation conditions
   ① BCW & LCA switch (indicated by the switch LED) is on.
   ② Vehicle Speed: 30 km/h or faster
   ③ Curvature radius: 100m or more
   ④ Relative car speed: -15 - 255km/h
   ("-" means overtaking the preceding vehicle)
7. Sensor deactivation conditions
   ① BCW & LCA switch (indicated by the switch LED) is off.
   ② Vehicle Speed: 28 km/h or slower

③ Curvature radius: 70m or less

④ Relative car speed: All except -15 - 255km/h

("-" means overtaking the preceding vehicle)

8. System control prohibition

① The radar is covered by debris: System conditions - Blockage message is outputted

> **Information**
> If the sensor on the rear bumper is contaminated by snow, mud or stickers, its detecting performance may be lowered.

② The radar installation is damaged by an outside shock: Send the error code

③ BCW & LCA system fails: Send the error code

④ The radar is overheated: System conditions - Over Temperature message is outputted.

9. Rear Cross-Traffic Collision Warning System (RCCW)

Item	Control value	Remarks
Activation speed	0 to -10 km/h (Reverse)	Activate when the gear is shifted to R (Reverse) position
Time To Collision Value	2 - 3.5 sec	+: closing
Activation distance	0.5m - 25m	Vehicle basis

① Generates warning in case of collision risk with the vehicle approaching from left and right side of your vehicle while reversing out of the parking space.

② Based on the Time To Collision (TTC), the warning is generated for the vehicle that is possible to collide within 3.5 seconds.

> **Information**
> "Time To Collision (TTC): Time calculated using the relative distance/speed which is the time until the possible collision. (TTC is subject to change depending on the relative speed of the approaching vehicle)."

③ Warning zone is as follows:

Click to see large image...

10. BCA-R (Blind-Spot Collision-Avoidance Assist System - Rear)

Item	Control value	Remarks
Activation speed	60 - 180 km/h	Same front camera operation condition

11. RCCA (Rear Cross-Traffic Collision-Avoidance Assist System)

Item	Control value	Remarks
Activation speed	-1 to -10 km/h (Reverse)	Activate when the gear is shifted to R (Reverse) position
Time To Collision Value	2 - 3.5 sec	+ : closing
Activation distance	0.5m - 25m	Vehicle basis

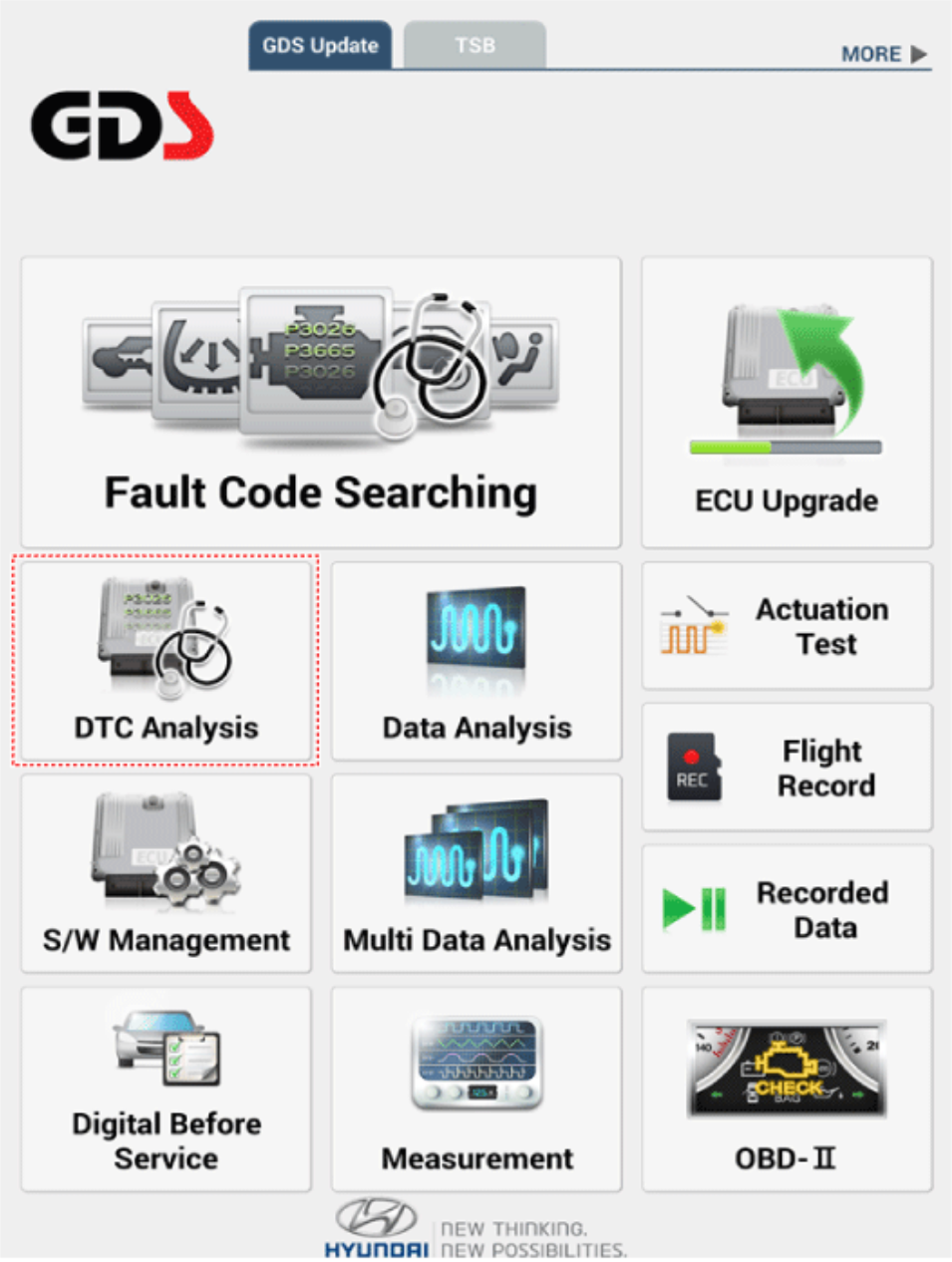
① The brake is applied if the vehicle does not stop even the warning is generated due to the collision risk while reversing out of the parking space.

② Based on the Time To Collision brake is applied for the vehicle within 2 seconds.

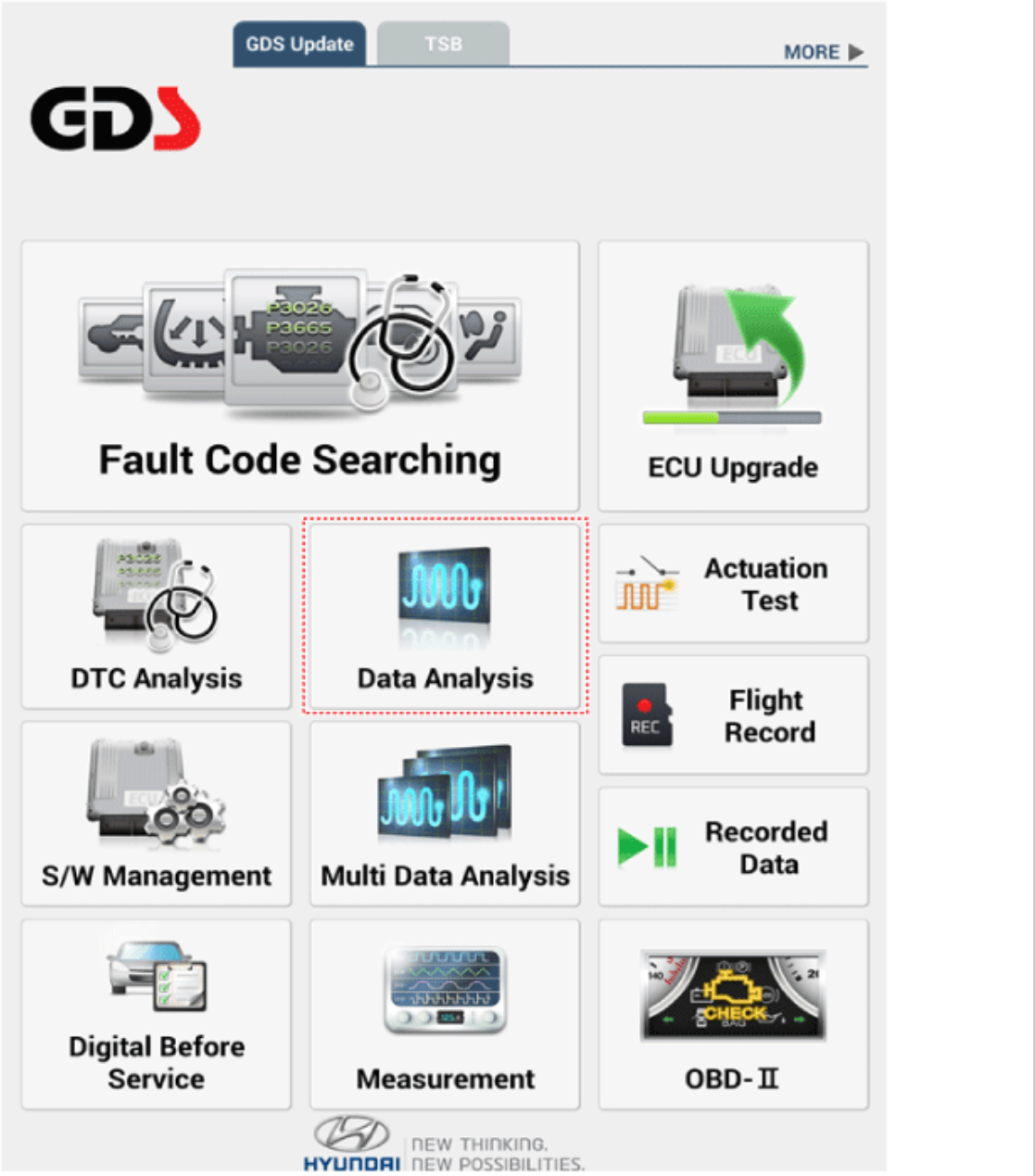
> **Information**
> "Time To Collision (TTC): Time calculated using the relative distance/speed which is the time until the possible collision. (TTC is subject to change depending on the relative speed of the approaching vehicle)."

Diagnosis with Diagnostic tool

1. In the body electrical system, failure can be quickly diagnosed by using the vehicle diagnostic system (Diagnostic tool).
   The diagnostic system (Diagnostic tool) provides the following information.
   (1) Fault Code Searching : Checking failure and code number (DTC)
   (2) Data Analysis : Checking the system input/output data state
   (3) Actuation test : Checking the system operation condition
   (4) S/W Management : Controlling other features including system option setting and zero point adjustment
2. Connect the cable of Diagnostic tool to the data link connector in driver side crash pad lower panel, and turn on the Diagnostic tool.
3. If diagnose the vehicle by Diagnostic tool, select "DTC Analysis" and "Vehicle".



4. If check current status, select the "Data Analysis" .



5. Select "BCW", if you want to check current data of BCW system.

Click to see large image...

Click to see large image...

6. If you want to check each module operation forcefully, select "Actuation test".

Click to see large image...

- Circuit Diagram

Click to see large image...

- Removal

1. Disconnect the negative (-) battery terminal.
2. Remove the rear bumper.
   (Refer to Body - "Rear Bumper")
3. Remove the blind spot radar unit (A) after loosening the mounting nuts.

[LH]

Click to see large image...

[RH]

Click to see large image...

4. When replace the bracket, disconnect the radar connector (A) after loosening the mounting nuts.

Click to see large image...

⚠ CAUTION

- Radar does not work normally if the bracket is physically changed or damaged.

- Installation

1. Install the blind spot radar unit and bracket.

   Tightening torque :
   bracket : 0.82 - 1.17 kgf.m (8.1 - 11.5 N.m, 5.97 - 8.48 lb-ft)
   unit : 0.31 - 0.37 kgf.m (3.1 - 3.7 N.m, 2.28 - 2.72 lb-ft)

2. Install the rear bumper.

3. Connect the negative (-) battery terminal.

> **NOTICE**
> - Take care not to confuse left side (master) and right side (slave) unit when installing.
> - BCW units connector connect to the wiring connector.

4. Perform "Correcting the Rear Corner Radar Unit Angle" procedures.
5. Perform "BSD Radar Calibration" procedures.

- Inspection

Correcting the Blind-Spot Radar Unit Angle

1. After replacing the blind-spot radar unit or bracket, with the bumper removed, use the blind-spot radar unit correction tool set (special tool : 09985-3T500) to perform angle correction.

> **⚠ CAUTION**
> - Perform the task on a level place.
> - Perform the task after checking the tire pressure.

> **Information**
> - For the dealer who purchased the existing blind-spot radar correction tool set (09958-3T000), refer to the instructions of the 17MY shop manual and repair it.

2. Attach a vertical plumb (special tool : 09958-3T010) on the hood, and lower the plumb (A) to the ground so that it passes through the center of the emblem.

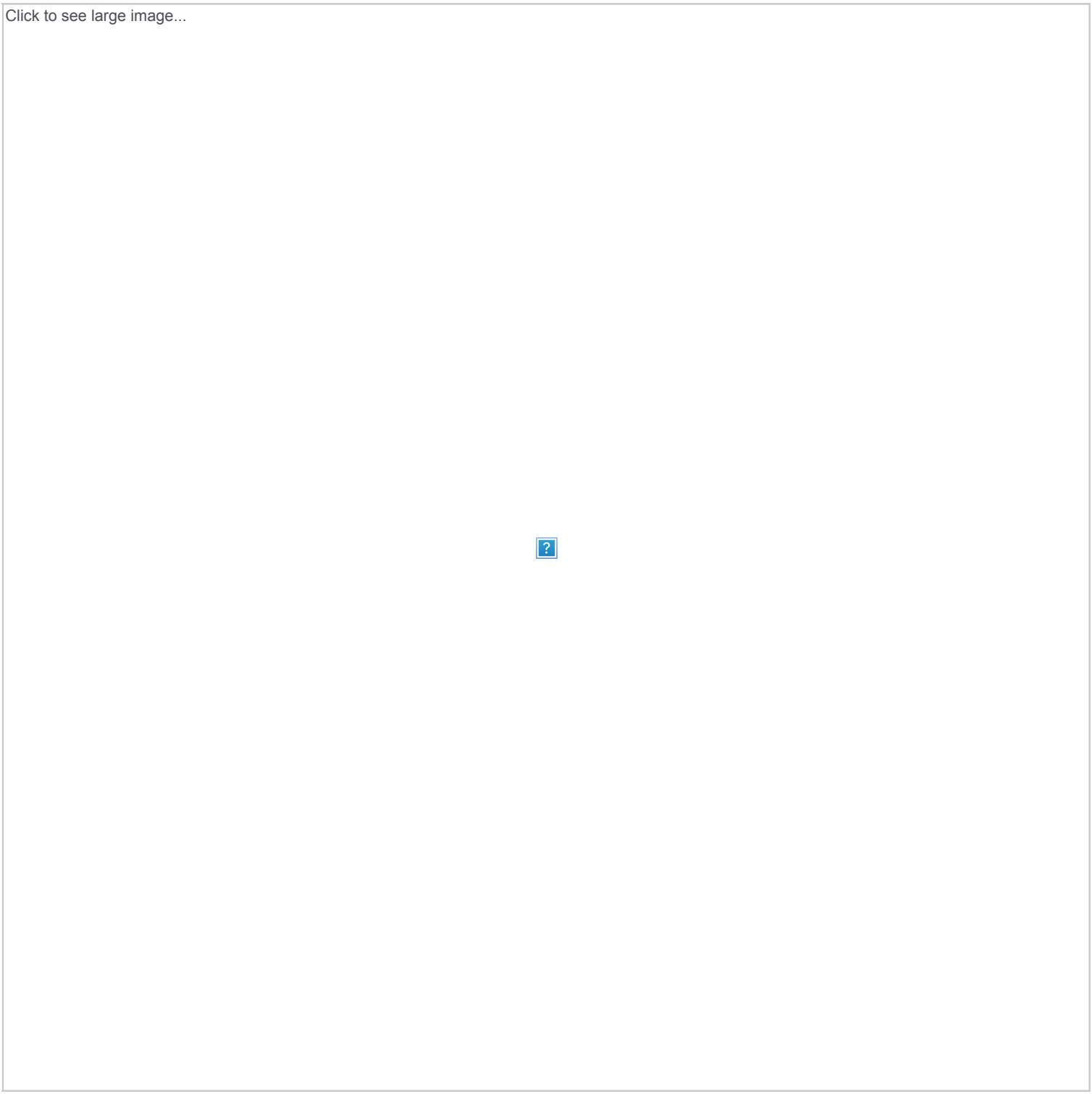
Click to see large image...

3. Marking the center point below the plumb (A).

Click to see large image...

4. Attach a vertical plumb (special tool : 09958-3T010) on the trunk (or tailgate), and lower the plumb (A) to the ground so that it passes through the center of the emblem.

Click to see large image...



5. Marking the center point below the plumb (A).

Click to see large image...

6. Marking the center of vehicle by a string.
   1) Pass the string through the bottom of the vehicle from the rear of the vehicle to the front and fix the string to the center point (A) of the front of the vehicle.
   2) Fix the string to the point (C) about 1.5 - 2m from the back of the vehicle so that it passes the rear center point (B).

Click to see large image...

7. Mount the blind-spot radar unit fixing adaptor (special tool : 09958-3T080) on the blind-spot radar unit and fix the level laser (special tool : 09958-3T070).

Click to see large image...

NOTICE

- When with the blind-spot radar unit cover, remove the cover and then mount the fixing adapter (special tool: 09958-3T080).

8. Measure the angle (C) between the center line (A) of the angle measuring plate and the horizontal laser beam (B) using a digital protractor (special tool : 09958-3T090).

Horizontal Angle (C):54° ± 3°

Click to see large image...

9. Use a digital inclinometer (special tool : 09958-3T100) to measure the vertical angle of the blind-spot radar unit.

Vertical Angle: 87° ± 1.5°

Click to see large image...

10. Measure the horizontal and vertical angles of left and right blind-spot radar units. If the measured values deviate from the specified values, insert a washer between the bracket of the blind-spot radar unit.

Specified Values

Horizontal Angle: 54° ± 3°

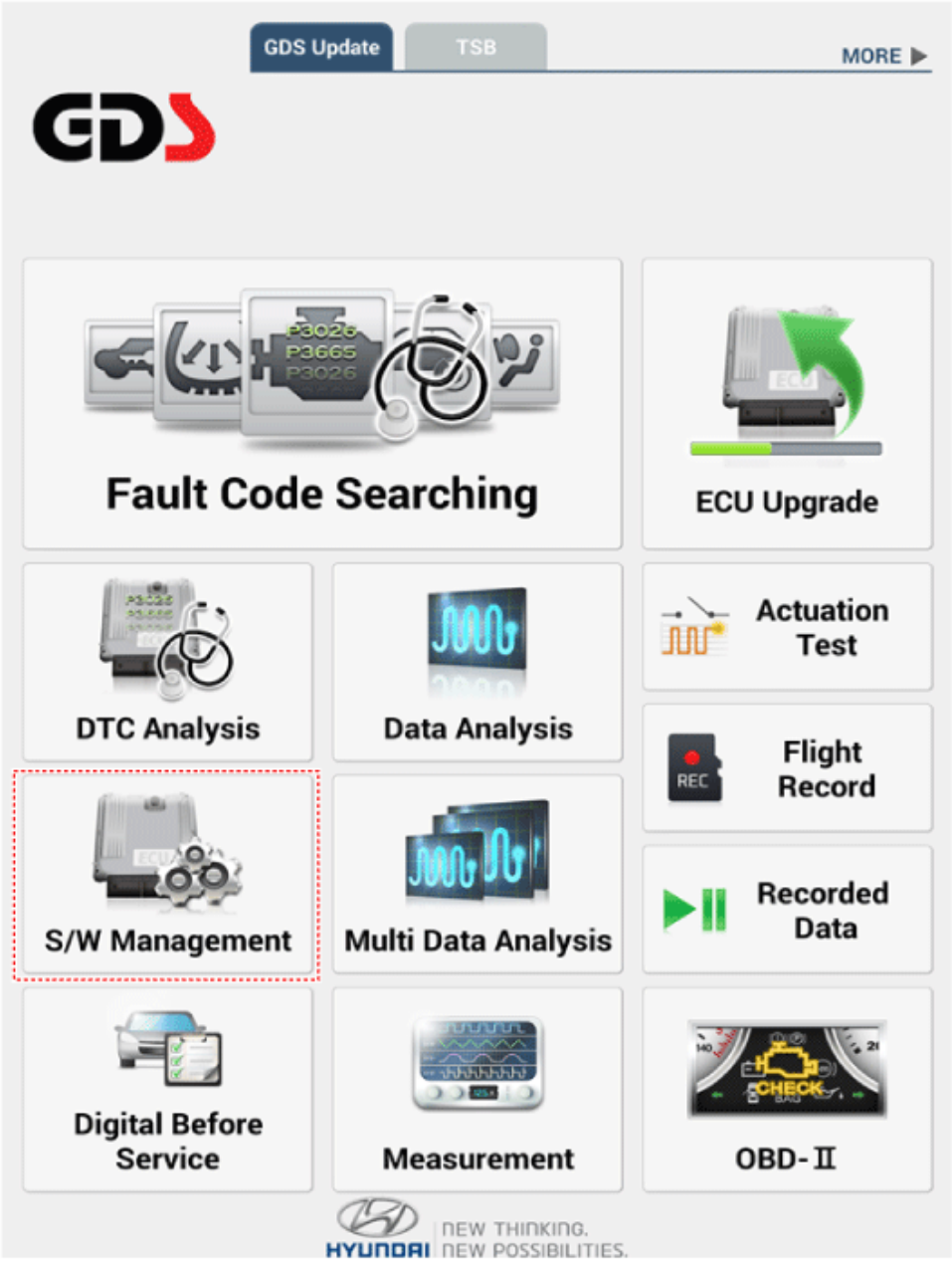
Vertical Angle: 87° ± 1.5°

Click to see large image...

11. After checking and correcting the blind-spot radar unit angle, perform the blind-spot radar radar correction procedure.

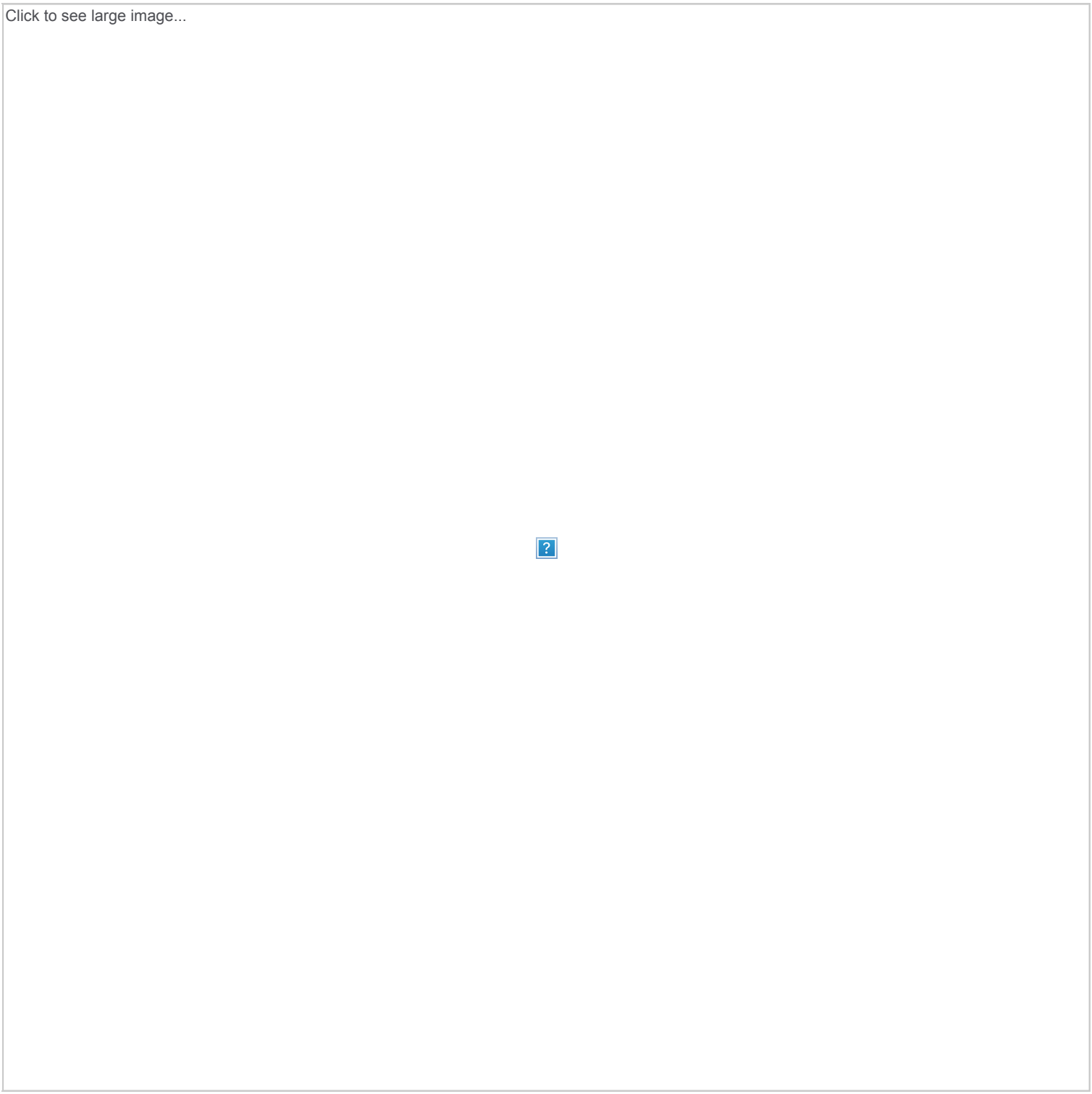
Diagnosis with Diagnostic tool

1. Rear bumper accident vehicles and vehicles that replaced BCW units must perform BCW unit alignment using Diagnostic tool.
2. Connect the cable of Diagnostic tool to the data link connector in driver side crash pad lower panel, and turn on the Diagnostic tool.
3. Select the 'S/W Management' and 'Car model'.



4. Select "Blind -Spot Collision Warning" and "BSD Radar Calibration".

Click to see large image...



5. Perform the "BSD Radar Calibration" procedure according to the Diagnostic tool screen message.

Click to see large image...

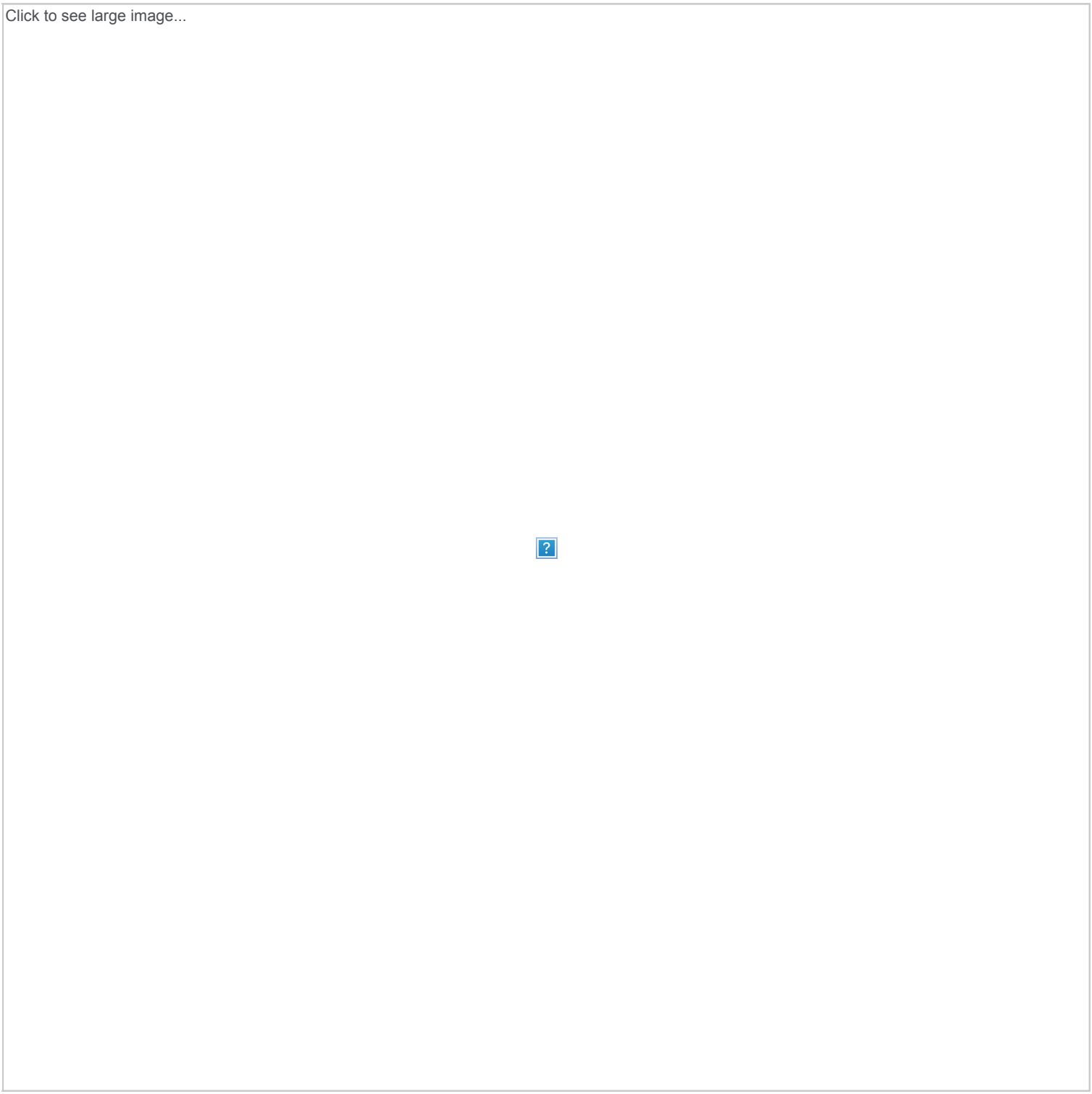
- Circuit Diagram

Click to see large image...

- Inspection

1. Disconnect the negative (-) battery terminal.
2. Remove the crash pad lower panel.
   (Refer to Body - "Crashpad Lower Panel")
3. Remove the side air vent duct (LH).

Click to see large image...



4. Remove the lower crash pad switch assembly after loosening the screws.

Click to see large image...

5. Remove the rheostat switch connector.

Click to see large image...

6. Check for intensity of new rheostat switch. If the light intensity of the lamps changes smoothly without any flickering when the rheostat is turned, it can be assumed that the rheostat is normal.

Click to see large image...

- Components

Click to see large image...

1. BCW Indicator
2. SVM camera

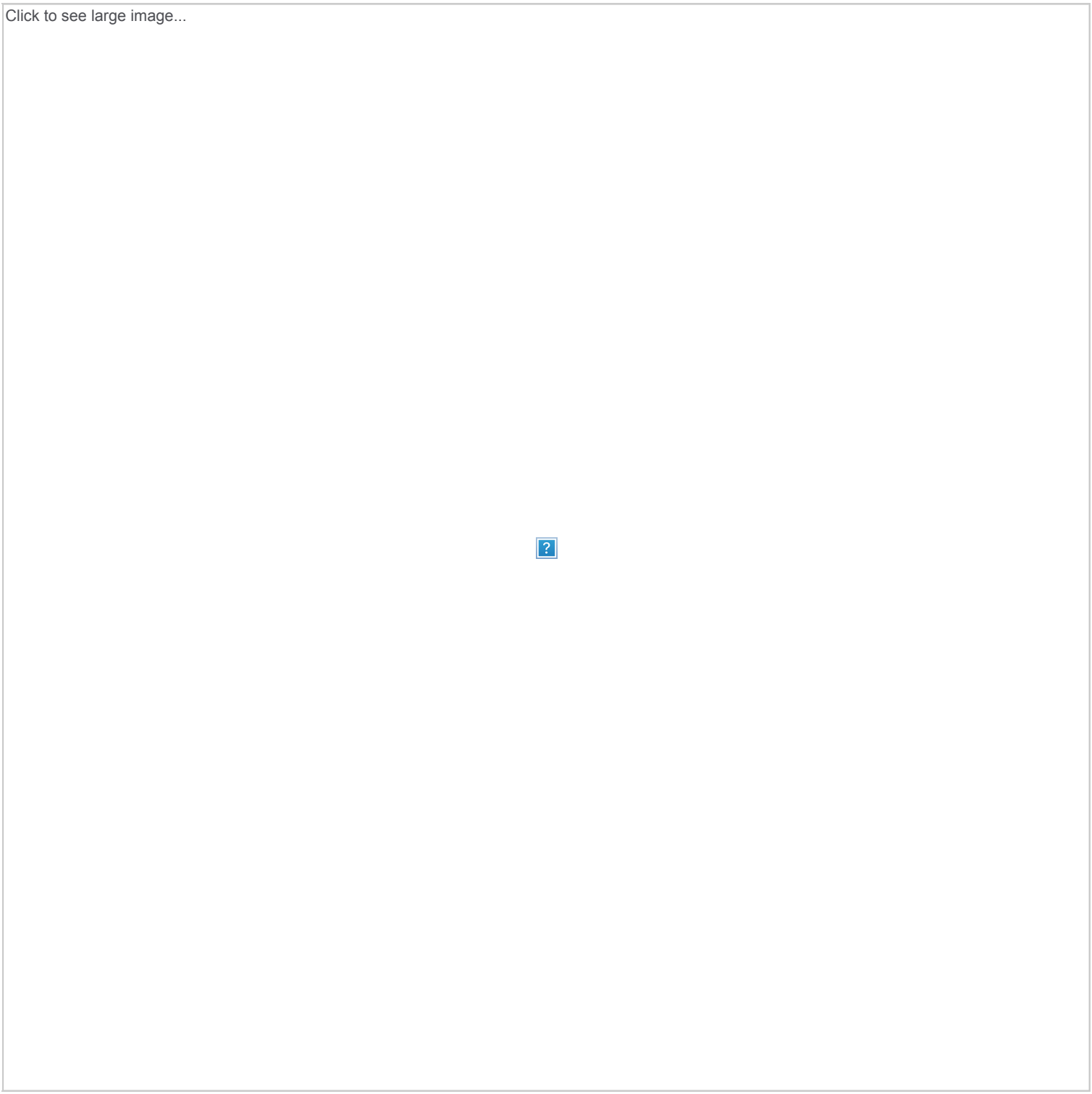
- Removal

1. Disconnect the negative (-) battery terminal.
2. Remove the front door trim.
   (Refer to Body - "Front door trim")
3. Remove the outside rear view cover (A).

Click to see large image...

4. Disconnect the mirror connector (A).

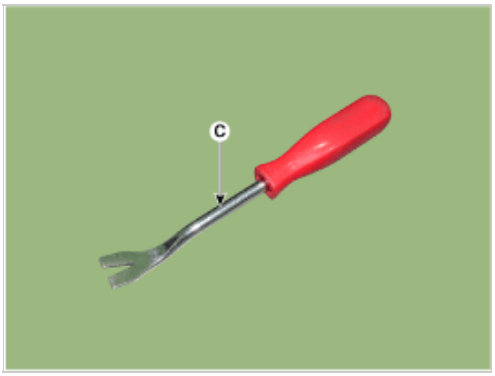
Click to see large image...

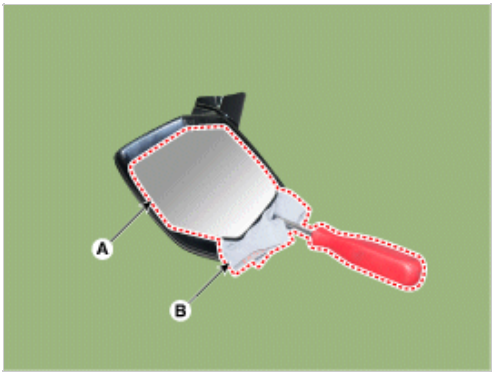


5. Loosen the mounting nut and then remove the outside rear view mirror.

Click to see large image...

6. Using a fastener remover (C), remove the mirror (A) as illustration below.





⚠ CAUTION

- Protect mirror from removing tool with cloth (B) wrapped.
- Be careful not to damage mirror and mirror housing during removing process.
- Apply force around the center of mirror because to apply force the end of mirror will break it.

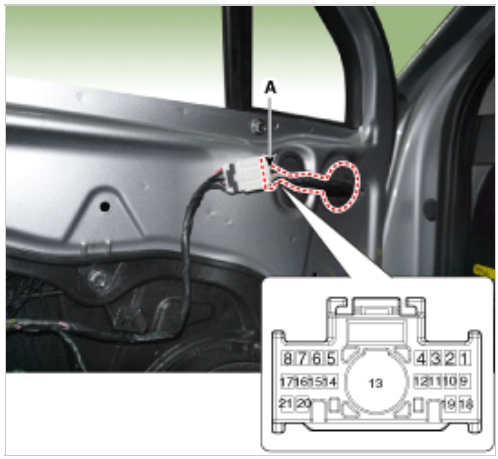
7. Disconnect heat wire connectors (A) and then remove the mirror.

- Installation

1. Install the outside mirror.
2. Connect the negative (-) battery terminal.

- Inspection

1. Disconnect the power door mirror connector from the harness


A
8 7 6 5
4 3 2 1
17 16 15 14
13
12 11 10 9
21 20
19 18

Click to see large image...

- Component Location

Click to see large image...

1. Front view camera
2. Cluster
3. LKA ON/OFF Switch

- Description

Blcok Diagram

Click to see large image...

Functions of Front View Camera

Front View Camera supports the following functions using the information (lane, light source, vehicle and pedestrian) detected by the front view camera and the vehicle's signal information (CAN communication).

1. Lane Keeping Assist (LKA) : If it is judged that the vehicle leaves the road during driving, the driver is warned of the danger and the steering is controlled in order to prevent the accident. The LKA provides visual / audible warning to the driver if it is determined that the lane departs from the lane in consideration of the lane and road boundary information recognized by the front view camera and whether or not the turn signal lamp operates.

   However, the front view camera may not operate normally in the limit situation where the lane and road boundaries can not be recognized.

2. High Beam Assist (HBA) : High Beam Assist (HBA) controls the operation of the high beam in order to maximize the front visual range while minimizing casting the glare on other drivers at night and under low light conditions. The system uses the front camera to detect whether there is any light source from the front or oncoming vehicle or street light. The system turns off the high beam if there is a light source and turns on the high beam if there is no light source. However, when the front view camera is unable to detect the surrounding situation, the system may not operate normally.

3. Forward Collision-Avoidance Assist(FCA) : It warns the driver of risk and controls the braking of the vehicle to prevent collision with front obstacle during driving.

   (If Sensor Fusion FCA is equipped) THE MFC transmits the recognition information about the forward vehicle/pedestrain to the front radar using CAN communication for FCA operation.

4. Driver Attention Warning(DAW) : If it is judged that the driver is inattention driving, the driver is warned to prevent an accident. The DAW analyzes the driving patttern of the driver in consideration of the lane information recognized by the front camera and the information such as the speed/steering angle/brake operation of the vehicle, and gives a visual/audible warning to the driver when it is determined that the driver is inadvertent driving.

   However, the front camera may not operate normally in a marginal situation where the surroundings can not be recognized.

5. Lane Following Assist (LFA): It is a driving system that controls steering so that it can be driven in the center of the lane for the purpose of mitigating the operating load while driving. LFA assists in steering so that it can be driven in the center of the lane, taking into account lane and road boundary information recognized by the front camera.

   However, for safety reasons, the driver should always keep an eye on the forward situation, since the front camera may not operate normally in a limit situation where lane recognition is not possible.

6. Highway Driver Assist (HDA): It is a driving system that controls steering/acceleration so that the speed set by the driver, safety distance from the vehicle ahead, and the vehicle can be centrally driven with the aim of mitigating the driving load while driving on highways and motorways.

   If the HDA determines that it is in the mainline of the highway mainline and motorway using navigation information, it will adjust the road speed to the speed set by the driver, or the speed limit of the road, but will maintain a safe distance from the center and forward vehicle by steering and deceleration control, taking into account lane information recognized by the front camera/front radar and relative speed of the vehicle.

   The HDA is released when the driver presses the Cancel switch or when the brakes are applied. The HDA also provides a visual/auditory warning to the driver if the driver has been removed from the steering wheel for more than a certain period of time, and is released if the driver still determines that the driver has not held the steering wheel.

System Operation

The functional requirements of MFC are as follows:

1. Lane Keeping Assist (LKA)
   – It operates when the LKA function is set and the vehicle speed is over 40mph(60km/h).
   (LKA Function Setting : LKA Switch ON, USM LKA Mode)
   – The lines should be clearly separated, and both lanes should be detected.
   – The driver's hand should be placed on the steering wheel and the function is canceled if ignoring the steering force when the LKA function is activated.
   – LKA will operate If the lane change is made arbitrarily while the turn signal lamp and emergency light switch are OFF.
   – LKA operates at a lane width of 2.8m or more and 4.3m or less.
   – If the vehicle crosses more than 40% of the width of the vehicle, it is judged that the lane is deviated to change the lane and the LKA function is canceled.
   – In the following cases, the LKA may not operate.
   1) When driving on a steep curve
   2) Sudden braking or sudden change of lane
   3) When the ESC / VSM function is working

2. High Beam Assist (HBA)
   1) If the light switch is pushed to the instrument panel, the high beam is turned on and the HBA is OFF.
   2) Operates when the vehicle speed is more than 25mph(40km/h).
   3) Details of the operation according to the state of the lighting switch during operation of the High Beam Assist (HBA) system are as follows:
   – If the light switch is pushed to the instrument panel, the high beam is turned on and the HBA is OFF.
   – If the light switch is pulled up with the high beam being turned off, the high beam is turned on and HBA remains ON. (When you release the hand, the switch moves to the center and the high beam is turned off.)
   – When the light switch is turned on with the high beam turned on by the HBA, the high beam is turned off and the system is released.
   – If you turn the light switch from AUTO to the headlight position, the high beam is turned off and the system is released.
   – During HBA operation with high beam is turned on, the headlamp automatically switches to the high beam off state if:
   4) Detecting the headlights or tail lights of an approaching vehicle
   – Detecting the headlights or tail lights of an approaching vehicle
   – Detecting the headlights or tail lights of bicycles and motorcycles
   – The surroundings are bright enough not to turn on the headlights
   – There is a street light or other light in front
   – The light switch is not in the AUTO (auto light) position
   – The HBA is turned off
   – The vehicle speed is reduced to 15mph(24km/h) or less
   5) Even if the HBA operating condition is satisfied, it does not work in the daytime.

6) Recognizes the lamp source of the preceding vehicle in normal nighttime environment and automatically high beam turns on or off.

- Variant Coding

Information

When you need variant coding:

– Replace Front View Camera with a new one

※ EOL Variant Coding and calibration required for new replacement

Front View Camera Variant Coding

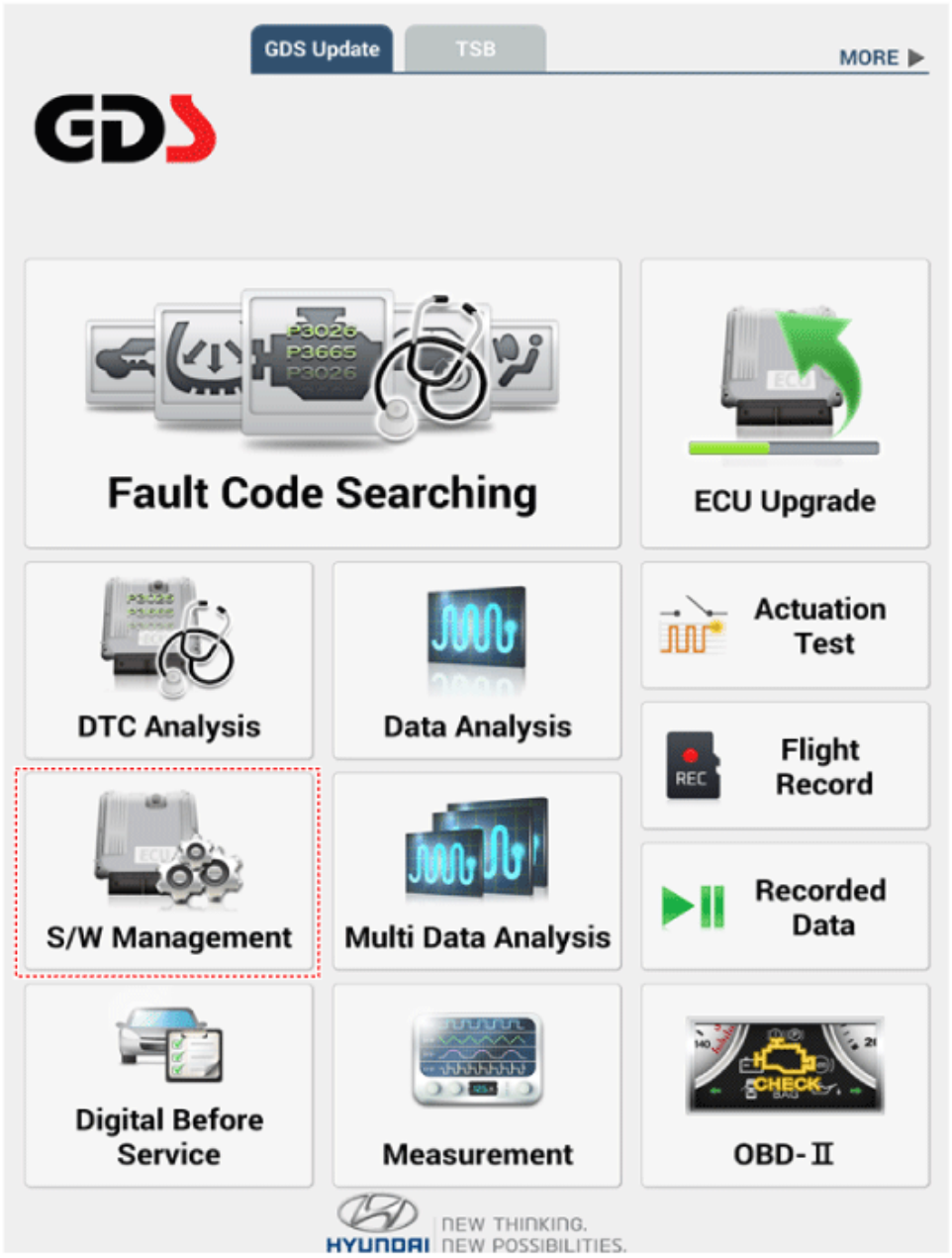
Front view camera variant coding makes it possible to operate functions for each vehicle type. If the variant coding differs from the vehicle specification, the "variant coding error" DTC is displayed.

1. Procedure for coding variants

(1) You should read the specification information for the front view camera that is installed in the vehicle before replacing it with a new front view camera.

(2) Connect the cable of Diagnostic tool to the data link connector in driver side crash pad lower panel, and turn on the Diagnostic tool.

(3) Select the 'S/W Management' and 'Car model'.



(4) Select "System Identification".

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Click to see large image...

(5) Select "Variant Coding".

Click to see large image...

(6) Enter the value of the specification read in procedure(4) in the new front view camera.

- Service Point Target Auto Calibration (SPTAC)

When you need calibration:

– Front view camera is removed and mounted
– Replace front view camera with a new one
– Windshield glass changed
– front view camera coupler of the windshield glass is deformed

Service Point Target Auto Calibration (SPTAC)

Front view camera SPTAC provides the method for the service technician to calibrate the camera by aligning the calibration target (SST: 09890-3V100) with the vehicle on a level ground.

If the calibration is not completed within the specified tolerance front view camera "System Out of Calibration" DTC is indicated.

1. Method for Correct Alignment of Calibration Target

   In order to complete the calibration of the front view camera successfully, install the calibration target as follows:

   – Install the target (SST: 09890-3V100) vertical to the ground and from the camera referring to the below tolerance angle.

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Click to see large image...

⚠ CAUTION

The tolerance ± 1˚ for the left and right gradient is very important and is sensitive to the flatness of the ground.

Install the compensator vertically using the Level Laser (SST: 09958-3T060 or 09964-C1200).

Arrange the Level Laser (A) on the center of the vehicle by installing it on the roof center above the vehicle's front windshield (same for both short and long distance calibrations) .

Click to see large image...

Have the laser illuminate starting from the roof center and to all the way to the center of the target, passing through the emblem center.

Click to see large image...

The level laser must be set to 'ON' and the holding (locking) function is not used.

NOTICE

Target is mounted to rigid backer material to maintain flatness requirements.

- Target has reflective (not faded or poorly painted) markings that are unlike from lane features.
- Target is 30 cm wide and 100 cm tall.
- Mounting area must NOT have cross hatch patterns or textual markings near the target.
- Target should be well lit for optimal performance using non-fluctuating illumination. There shall be no continuous shadows cast on the target.
- The light should be directed toward the target front and the target front should be brighter than the target rear and target.

Click to see large image...

2. Service Point Target Auto Calibration(SPTAC) Procedure
   1) It is recommended to check vehicle toe-in and tire pressure levels to ensure proper alignment of the camera to the "world" before proceeding with calibration. The vehicle to run the calibration routine is to be at nominal production loading capacity.
   2) Windshield must be clean and silk-screen checked so that there is no blockage of the camera.
   3) Service technician connects the diagnostic connector and starts the vehicle. The front view camera should not be activated by pressing the switch.
   4) The service calibration routine may not run correctly if any system level fault is active.
   5) If working with a replacement ECU: the service technician initiates the SPTAC Reset configuration.
   6) Service technician either aligns the vehicle to the target or the target to the vehicle.
      a. Locate the bottom of the target 90cm from the ground (max. tolerance: 1cm).
      b. Locate so that the central axis of the target and the central axis of the vehicle match (max. tolerance: 3cm).
      c. Locate the short-distance target (A) so that it adheres by 0 ~ 10cm (B) to the bumper front (max. tolerance: 5cm).
      d. The location of the long-distance target (C) is 100cm (D) before the bumper (max. tolerance: 5cm).

Click to see large image...

7) Select Camera Calibration under Option of Global Diagnosis System (Diagnostic tool).

Click to see large image...

Click to see large image...

8) The technician should complete the short-distance calibration after checking the target location and "OK" message on the Diagnostic tool.

Click to see large image...

9) The technician should complete the long-distance calibration after checking the target location and "OK" message on the Diagnostic tool (conduct the calibration twice: short and long distances).

Information

If the distance 100 ± 5 cm (39.4 ± 2 inch) is different from the distance indicated on the Diagnostic tool, calibrate it according to the value indicated on the Diagnostic tool.

Click to see large image...

Click to see large image...

Test Drive

⚠ CAUTION

– Be sure to perform test drive to check for normal operation after performing calibration.

– Drive on straight road (of longer than 500 m) with 2 white or yellow lane marks at speed of over 40mph(60km/h), and check for the alert as you intentionally steer close to the lane mark.

– LKA operates properly if the lane mark segment space is less than 8 m.

– Perform test drive on car-only road or on a highway.

NOTICE

The LKA may not activate properly in the following conditions

The LKA may not activate properly when:

– It is difficult to distinguish the lane from the road due to dust built up on the lane.
– It is difficult to distinguish the color of the lane line from the road.
– There is a mark that looks like a lane line near the line.
– The lane line is indistinct or damaged.
– The number of lanes increases or decreases or the lane lines are crossing (driving through toll plaza, toll gate, road merging or dividing area, etc.).
– There are more than two lane lines.
– The lane is very wide or narrow.
– The lane is not visible due to snow, rain, stain, a puddle or other factors.
– Shadows of objects (median strip, guard rail, noise barriers, etc.) surrounding the road are casted on the lane.
– The lane is congested or it is replaced by a structure in a construction area.
– There is a indication on the road surface such as crosswalk or road signs.
– The lane inside the tunnel is covered with dust or oil.
– The brightness outside changes suddenly such as when entering or exiting a tunnel.
– The head lamps are not on at night or in a tunnel, or light level is low.
– There is a boundary structure.
– Light such as street light, sunlight or oncoming vehicle light reflects from the water on the road.
– Driving with the sun in front of you.
– Driving on the bus-only lane or on the left/right of the lane.
– The lane suddenly disappears at certain locations such as at the intersection.
– The distance from the vehicle ahead is extremely short or that vehicle drives hiding the lane line.
– Driving on a steep grade or a sharp curve.
– The vehicle vibrates heavily.
– The surrounding of the inside rear view mirror temperature is high due to direct sun light.
– The lens or windshield is covered with foreign matter.
– Tthe sensor cannot detect the lane because of fog, heavy rain, or heavy snow.
– The windshield is fogged by humid air in the vehicle.
– Putting something on the crash pad.

NOTICE

The LKA may not activate properly in the following conditions :

• The LKA is a system to prevent lane departure and assist steering. In any case, do not rely on the steering assist system, and the driver must take the necessary precautions to determine safety matters.
– Driver is responsible for being aware of surroundings and steering the vehicle for safe driving practices.
– Do not steer the steering wheel suddenly when the steering wheel is being assisted by the system.
– LKA helps prevent the driver from moving out of the lane unintentionally by assisting the driver’s steering.
– LKA is not working if the camera cannot detect the lane or if the vehicle speed does not exceed 64km/h(40mph),
– Do not disassemble front view camera temporarily for tinted window or attaching any types of coatings and accessories.
– Do not allow any water or liquid to contact the front view camera.
– Do not remove the front view camera parts and do not damage the front view camera by a strong impact.
– Do not put objects that reflect light on the crash pad.
– Excessive noise can make the LKA alarm sound unheard.

High Beam Asisst (HBA)

NOTICE

The system may not operate normally in the below conditions.

– When the light from the oncoming or front vehicle is not detected because of lamp damage, hidden from sight, etc.
– When the lamp of the oncoming or front vehicle is covered with dust, snow or water.
– When the light from the oncoming or front vehicle is not detected because of exhaust fume, smoke, fog, snow, etc.
– When the front window is covered with foreign matters such as ice, dust, fog, or is damaged.
– When there is a similar shape lamp with the front vehicle’s lamps.
– When it is hard to see because of fog, heavy rain or snow.

– When the headlamp is not repaired or replaced at an authorized dealer.
– When headlamp aiming is not properly adjusted.
– When driving on a narrow curved road or rough road.
– When driving downhill or uphill.
– When only part of the vehicle in front is visible on a crossroad or curved road.
– When there is a traffic light, reflecting sign, flashing sign or mirror.
– When the road conditions are bad such as being wet or covered with snow.
– When the front vehicle’s headlamps are off but the fog lamps on.
– When a vehicle suddenly appears from a curve.
– When the vehicle is tilted from a flat tire or being towed.
– When the LDW/LKA warning light illuminates.
– Replace front view camera with a new one
– Windshield glass changed

- Component Location

Click to see large image...

- Removal

1. Disconnect the negative (-) battery terminal.
2. Remove the mirror wiring cover (A) and rain sensor cover (B).

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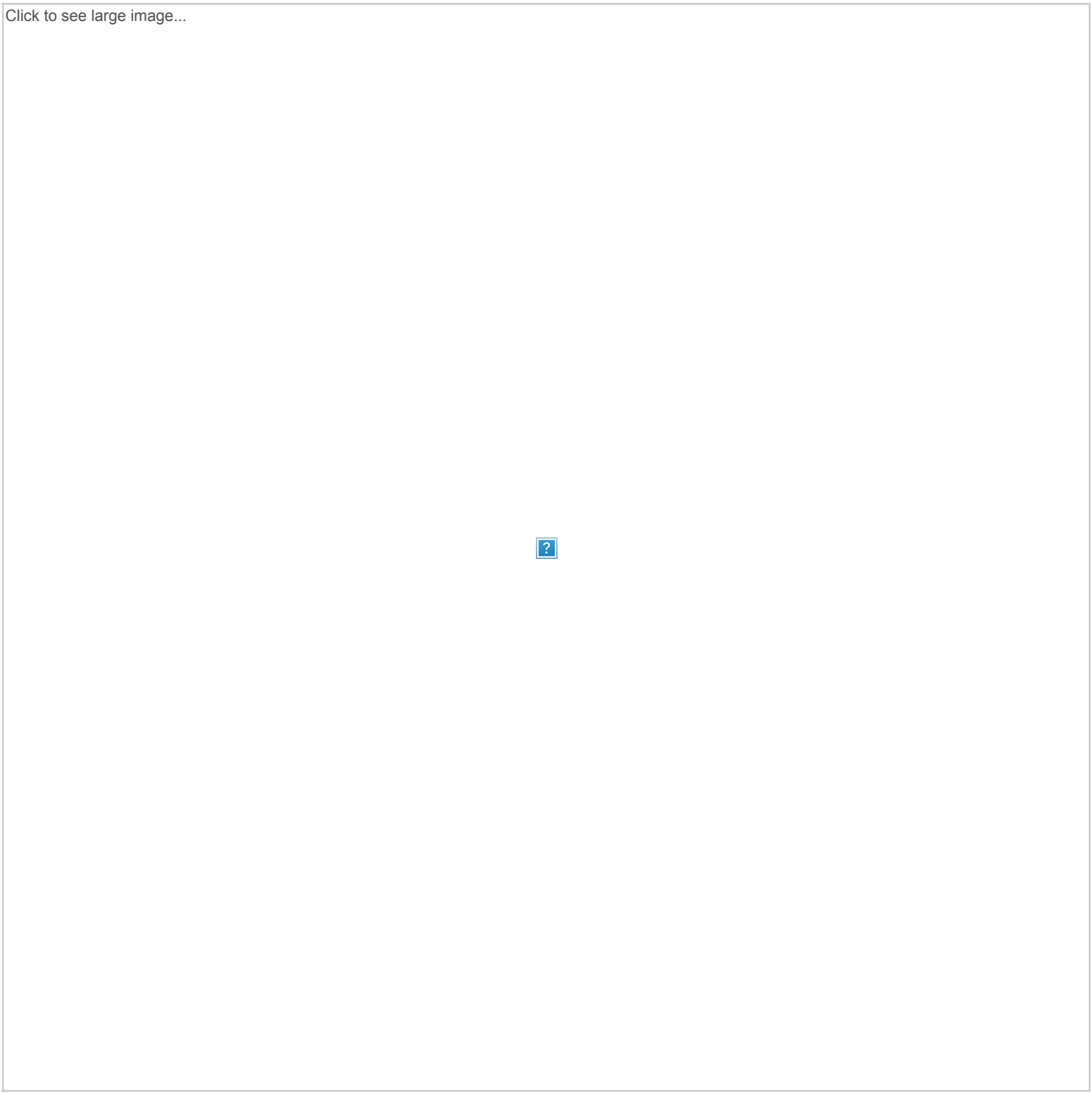

3. Disconnect the front view camera connector (A).

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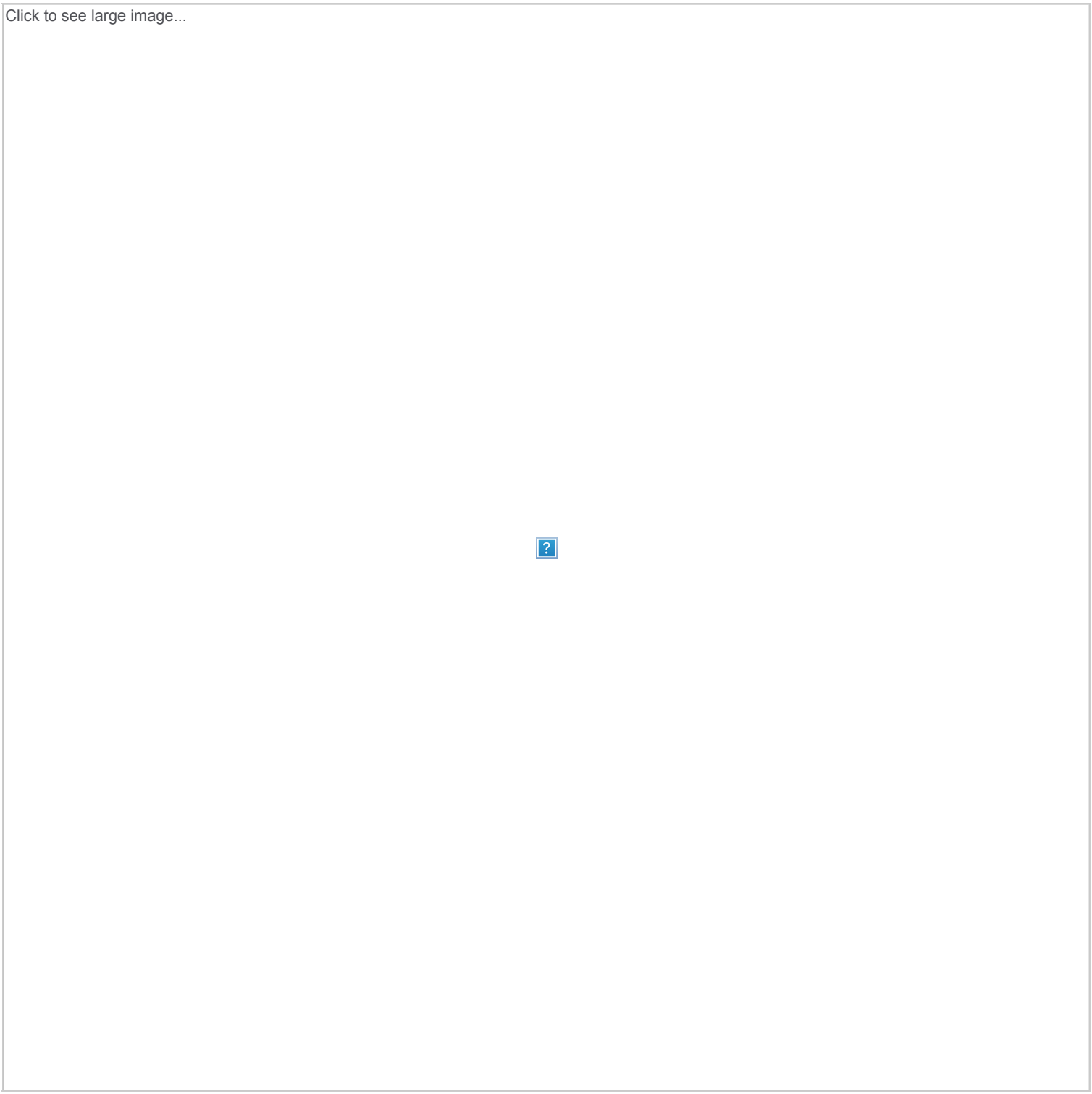

4. Separate the fixed points (B) of coupler, remove the front view camera (A).

Click to see large image...

NOTICE

• When separate the fixed points, be careful not to damage it.

- Installation

⚠ CAUTION

• When you need calibration

– Replace Front View Camera with a new one

– Front View Camera is removed and mounted

– Windshield glass changed
– Front View Camera coupler of the windshield glass is deformed

1. Align the reference point at alignment point (A) and align front view camera.

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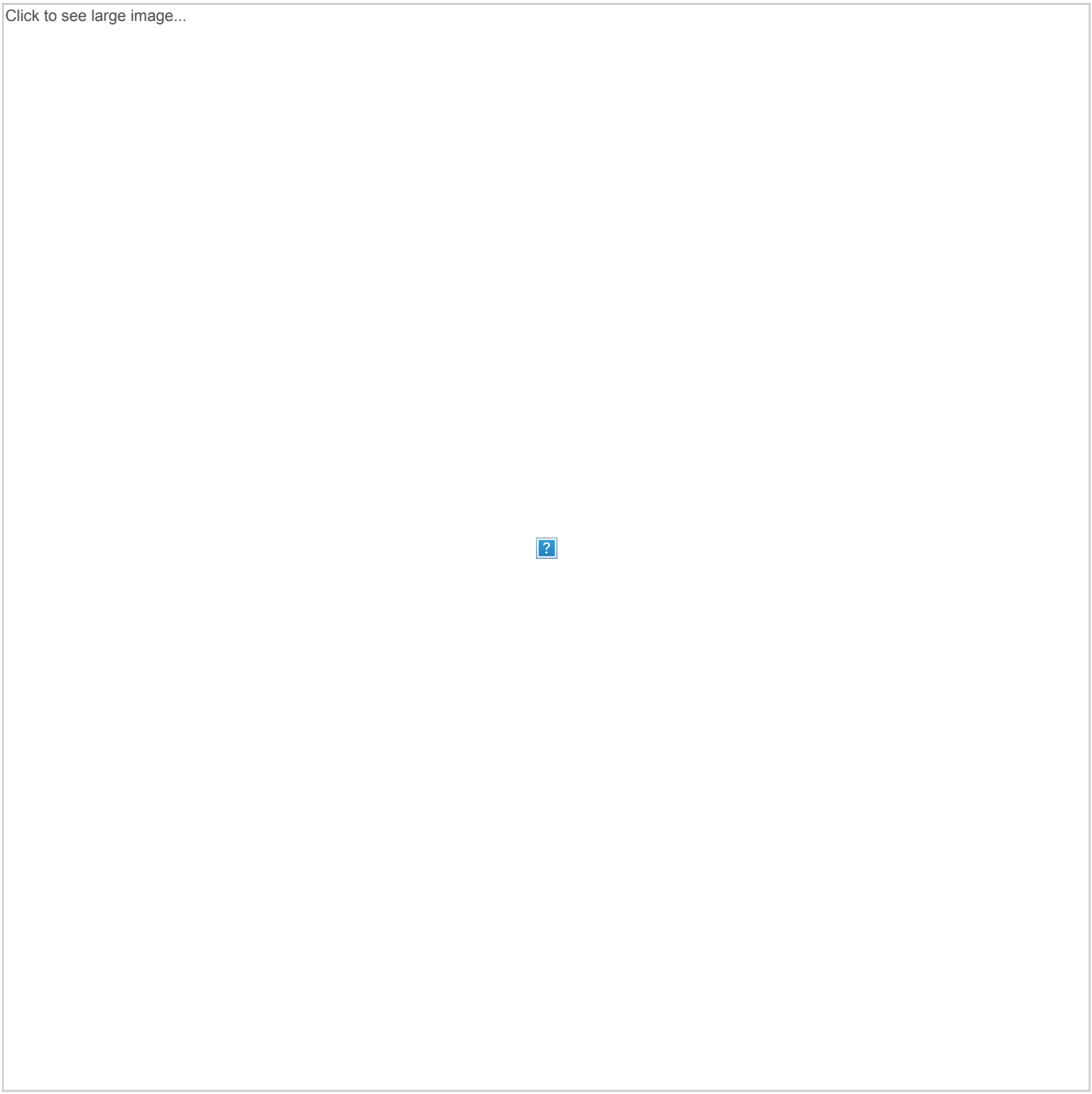

2. Apply force to lock position(B) to complete mounting.

Click to see large image...

NOTICE

- Fully assembly so that you can hear a'clicking' sound when assembling.

3. Connect the front view camera connector.
4. Install the front view camera cover.
5. Connect the negative(-) battery terminal.
6. Perform the "Variant Coding" with Diagnostic tool.
7. Perform the "Service Point Target Auto Calibration(SPTAC)" with Diagnostic tool.